TABLE OF CONTENTS

INTRODUCTION

Chapter 6 Introduction

This chapter covers electrical and lighting system requirements for all dwelling units and common use areas in multifamily buildings for newly constructed buildings and additions or alterations to existing buildings.

Guidance on general requirements is included in the Multifamily Compliance Manual Chapter 1: General Requirements. Guidance on administrative requirements is included in the Multifamily Compliance Manual Chapter 2: Compliance and Enforcement. This chapter includes guidance on electrical and lighting system requirements.

Table 6-1: Excerpt from Table 100.0-A Application of Standards provides an overview of the location of the electrical and lighting system requirements that apply to multifamily occupancies in the Energy Code.

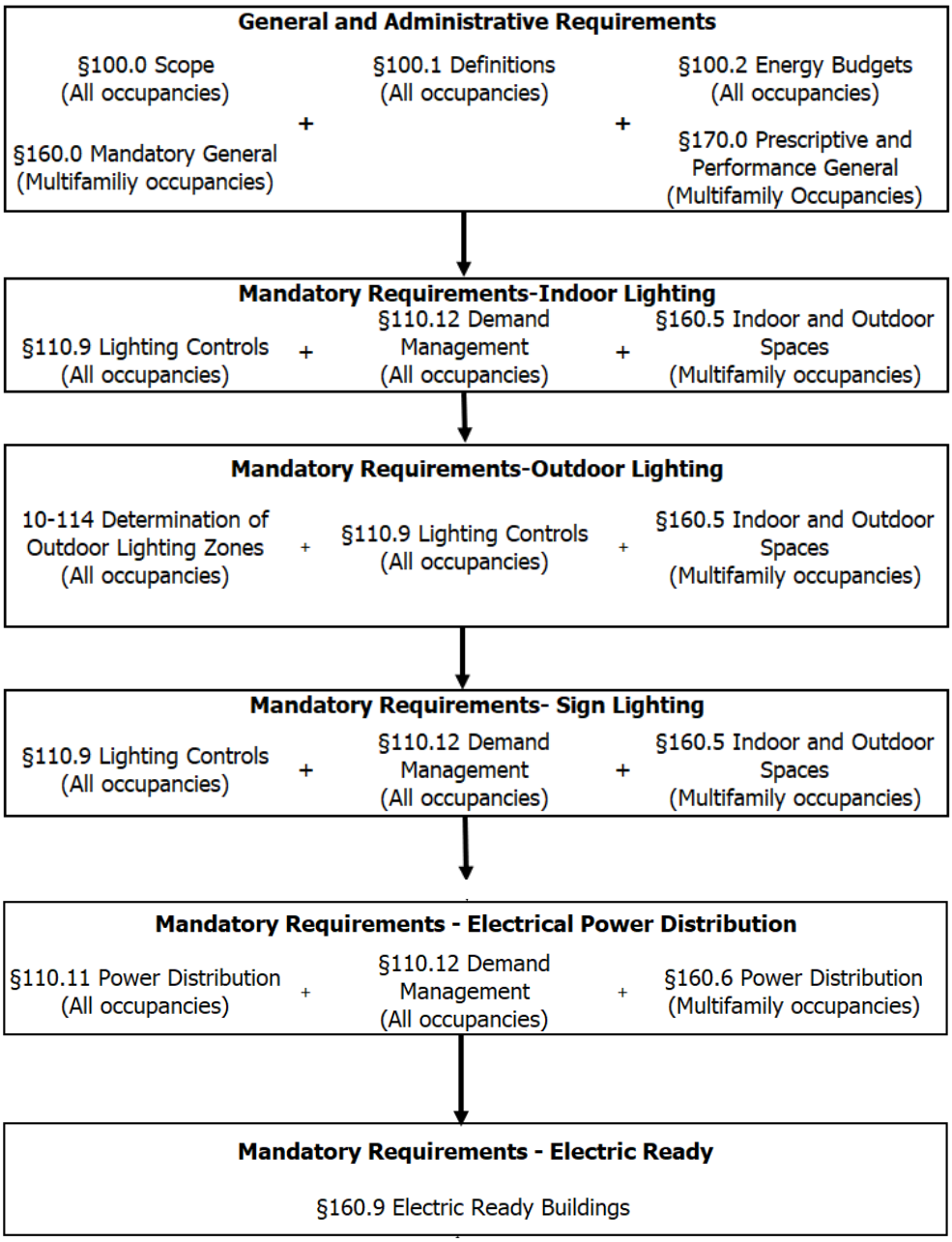
Table 6-1: Excerpt from Table 100.0-A Application of Standards

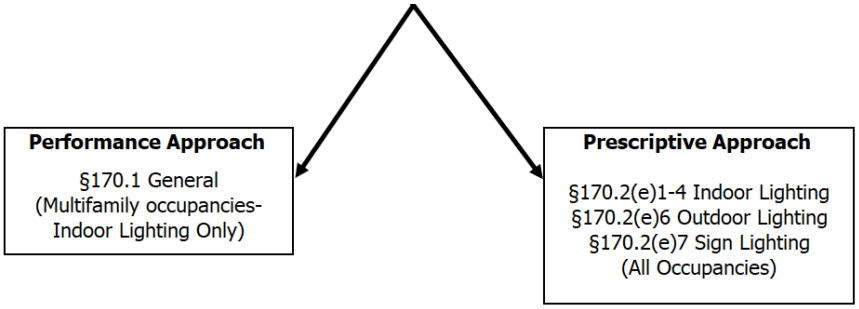
Application	Mandatory	Prescriptive	Performance	Additions/Alterations
General[1]	160.0	170.0	170.0	180.0
Indoor Lighting	110.9, 110.12 and 110.12(c), 160.5	170.2(e)1-4	170.1	180.1 (Additions) 180.2, 180.2(b)4, 180.2(c) (Alterations)
Outdoor Lighting	10-114, 110.9, 160.5	170.2(e)6	N/A	180.1 (Additions) 180.2, 180.2(b)4 (Alterations)
Sign Lighting	110.9, 110.12 and 110.12(d), 160.5	170.2(e)7	N/A	180.1 (Additions) 180.2, 180.2(b)4 (Alterations)
Electrical Power Distribution	110.11, 110.12 and 110.12(e), 160.6	N/A	N/A	180.1 (Additions) 180.2, 180.2(b)4 (Alterations)
Electric Ready	160.9	N/A	N/A	N/A

1. Guidance on General Requirements from Sections 160.0, 170.0 and 180.0 are included in the Multifamily Compliance Manual Chapter 1 General Requirements. Guidance specific to multifamily electrical and lighting is included in this chapter.

Figure 6-1: Flowchart Guidance for Application of New Construction Multifamily Electrical and Lighting Requirements and Figure 6-2: Flowchart Guidance for Application of Addition or Alteration Multifamily Electrical and Lighting Requirements below illustrate the applicable sections for newly constructed buildings and additions or alterations to existing buildings.

Figure 6-1: Flowchart Guidance for Application of New Construction Multifamily Electrical and Lighting Requirements

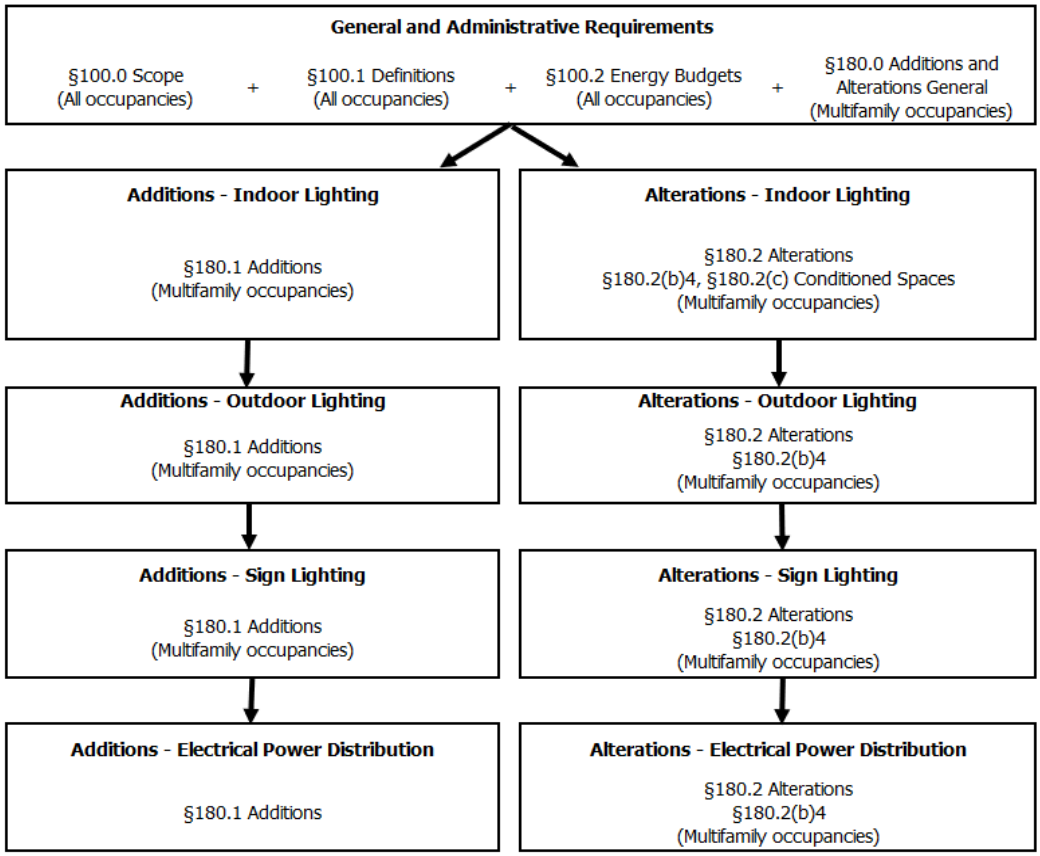




Newly Constructed Buildings Compliance Approaches

Source: California Energy Commission

Figure 6-2: Flowchart Guidance for Application of Addition or Alteration Multifamily Electrical and Lighting Requirements



Addition, Alteration Compliance Approaches

Source: California Energy Commission

10-114 – DETERMINATION OF OUTDOOR LIGHTING ZONES AND ADMINISTRATIVE RULES FOR USE

This section establishes rules for implementing outdoor lighting zones to show compliance with Section 140.7 of Title 24, California Code of Regulations, Part 6.

(a) Lighting Zones. Exterior lighting allowances in California vary by Lighting Zones (LZ).

(b) Lighting Zone Characteristics. TABLE 10-114-A specifies the relative ambient illumination level and the statewide default location for each lighting zone.

(c) Amending the Lighting Zone Designation. A local jurisdiction may officially adopt changes to the lighting zone designation of an area by following a public process that allows for formal public notification, review, and comment about the proposed change. The local jurisdiction may determine areas where Lighting Zone 4 is applicable and may increase or decrease the lighting zones for areas that are in State Default Lighting Zones 1, 2 and 3, as specified in TABLE 10-114-A.

TABLE 10-114-A LIGHTING ZONE CHARACTERISTICS AND RULES FOR AMENDMENTS BY LOCAL JURISDICTIONS

Zone	Ambient Illumination	Statewide Default Location	Moving Up to Higher Zones	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 2020 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,	Developed portion of a government designated park, recreation area, or wildlife preserve, can be designated as LZ2 or LZ3 if they are cRetail stores, located in a residential neighborhood, and rural town centers can be	Not applicable.

		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.	designated as LZ2 if the business operates during hours of darkness.	
LZ2	Moderate	Urban areas, as defined by the 2020 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 mixed-use residential area or city center.	Special districts may be designated as LZ1 by the local jurisdiction, without any size limits.
LZ3	Moderately High	Urban areas, as defined by the 2020 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 may be designated as LZ1 or LZ2 by the local jurisdiction, without any size limits.
LZ4	High	None.	Not applicable.	Not applicable.

«»Commentary for Section 10-114(c):

The Energy Code allows outdoor lighting power on the amount of light and subsequent surface brightness of the surrounding conditions. The Energy Code contains lighting power allowances for new lighting installations and specific alterations that depend on the lighting zone (LZ) where the project is located.

Five categories of outdoor lighting zones are defined: LZ0, LZ1, LZ2, LZ3, and LZ4. Lighting zones with lower numbers are less illuminated, starting at LZ0, such as national parks and other areas intended to be very dark at night, through to LZ4 for high-intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very illuminated levels.

Over a period of time, human vision will adapt to darker surrounding conditions and less light is required to see properly. Providing more light than is needed can potentially create debilitating glare and a need for higher light levels to counteract the reduced vision. As future projects are built, they must also compete with the light levels and glare that has been established in previous nearby projects, leading to unnecessarily greater wasted energy as the properties rachet up the light levels.

The least amount of lighting is allowed in LZ1, and increasingly more amount of lighting is allowed in LZ2, LZ3, and LZ4. LZ0 is intended for undeveloped spaces in parks and wildlife preserves and is of very low ambient illumination.

The default lighting zone for undeveloped portions of government designated parks, recreation areas, and wildlife preserves is Lighting Zone 0.

The default lighting zone for developed portions of government designated parks, recreation areas, and wildlife preserves is Lighting Zone 1.

The default for rural areas as defined by the U.S. Census Bureau is Lighting Zone 1.

The default lighting zone for urban areas as defined by the U.S. Census Bureau is Lighting Zone 2.

Lighting Zone 3 is the default for urban areas, as defined by the U.S. Census Bureau. However, local jurisdictions may designate specific areas as higher or lower than the default lighting zone if deemed appropriate. Examples include using a higher level lighting zone in areas with commercial activities, or using lower level lighting zones in residential areas or environmentally sensitive areas. When a local jurisdiction adopts changes to the lighting zone boundaries, it must follow a public process that allows for formal public notification, review, and comment about the proposed change.

Permit applicants may determine the lighting zone for a particular property using the following steps.

For government-designated parks, recreation areas, and wildlife preserves:

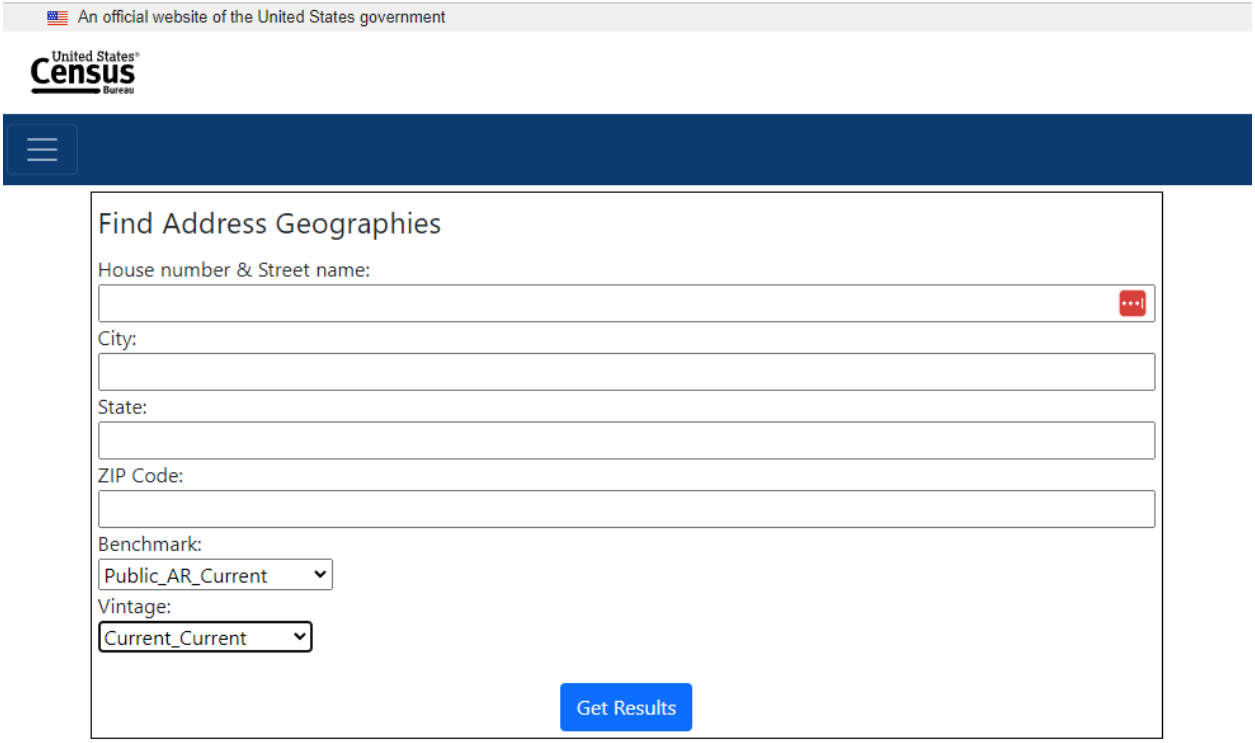
1. Check with the local jurisdiction having authority over permitting of the property. The local jurisdiction will know if the property is a government-designated park, recreation area, or wildlife preserve, and therefore in default Lighting Zone 0 or 1. The local jurisdiction also may know if the property is contained within the physical boundaries of a lighting zone for which a locally adopted change has been made.

For urban areas and rural areas:

1. The lighting zones for urban areas and rural areas as well as the legal boundaries of wilderness and park areas are based on the 2020 U.S. Census Bureau boundaries.

2. The U.S. Census Bureau website can be used to determine if the property is within Lighting Zone 1 (rural areas), Lighting Zone 2 (urban areas), or Lighting Zone 3 (urban areas).
3. Using an online map overlay tool provided by the U.S. Census Bureau on https://geocoding.geo.census.gov/geocoder/geographies/address?form the property address can be entered to look up geography results indicating whether the address is within an urban area or rural area once the "vintage" is changed to "Census2020_Current".

Figure 6-3 U.S. Census Bureau Website: https://geocoding.geo.census.gov/geocoder/geographies/address?form



Source: California Energy Commission

SECTION 110.9 – MANDATORY REQUIREMENTS FOR LIGHTING CONTROLS

(a) All lighting control devices and systems and all light sources subject to the requirements of Section 110.9 shall meet the following requirements:

1. Shall be installed only if the lighting control or light source complies with all of the applicable requirements of Section 110.9.
2. Lighting controls may be individual devices or systems consisting of two or more components.

(b) All lighting controls. Lighting controls listed in Section 110.9(b) shall comply with the requirements listed below; and all components of the system considered together as installed shall meet all applicable requirements for the application for which they are installed as required in Sections 130.0 through 130.5, Sections 140.6 through 140.8, Section 141.0, and Section 150.0(k).

1**. Time-switch lighting controls.** All controls that provide time-switch functionality, including all automatic and astronomical time-switch controls, shall have program backup capabilities that prevent the loss of the device's schedule for at least 7 days, and the device's date and time for at least 72 hours if power is interrupted. In addition:

A. Time-switch controls installed in nonresidential buildings shall:

i. For each connected load, be capable of providing manual override to each connected load and of resuming normally scheduled operation after a manual override is initiated within 2 hours; and

ii. Provide an automatic holiday shutoff feature that turns off all connected loads for at least 24 hours and then resumes normally scheduled operation.

B. Astronomical time-switch controls shall:

i. Have sunrise and sunset prediction accuracy within plus-or-minus 15 minutes and timekeeping accuracy within 5 minutes per year;

ii. Be capable of displaying date, current time, sunrise time, sunset time, and switching times for each step during programming;

iii. Be capable of automatically adjusting for daylight savings time; and

iv. Have the ability to independently offset the on and off for each channel by at least 90 minutes before and after sunrise or sunset.

C. Multilevel time-switch controls shall include at least two separately programmable steps per zone.

D. Time-switch controls installed outdoors shall have setback functions that allow the lighting on each controlled channel to be switched or dimmed to lower levels. The setback functions shall be capable of being programmed by the user for at least one specific time of day.

2. **Daylight responsive controls.** Controls that provide daylight responsive controls functionality shall:

A. Automatically return to its most recent time delay settings within 60 minutes of the last received input when left in calibration mode;

B. Have a set point control that easily distinguishes settings to within 10 percent of full-scale adjustment;

C. Provide a linear response within 5 percent accuracy over the range of illuminance measured by the light sensor; and

D. Be capable of being calibrated in a manner that the person initiating the calibration is remote from the sensor during calibration to avoid influencing calibration accuracy, for example by having a light sensor that is physically separated from where the calibration adjustments are made.

3. **Dimmers.** Controls that provide dimming functionality shall:

A. Be capable of reducing lighting power consumption by a minimum of 65 percent when at its lowest setting;

B. Provide reduced flicker operation, meaning that directly controlled light sources shall be provided electrical power such that the light output has an amplitude modulation of less than 30 percent for frequencies less than 200 Hz without causing premature lamp failure;

C. Provide an offsetting that produces a zero lumen output; and

D. For wall box dimmers and associated switches designed for use in three way circuits, be capable of turning lights off, and on to the level set by the dimmer if the lights are off.

4. **Occupant sensing controls.** Occupant sensing controls include occupant sensors, motion sensors, and vacancy sensors, including those with a partial-ON or partial-OFF function. Occupant sensing controls shall:

A. Be capable of automatically turning the controlled lights in the area either off or down no more than 20 minutes after the area has been vacated;

B. For manual-on controls, have a grace period of no less than 15 seconds and no more than 30 seconds to turn on lighting automatically after the sensor has timed out; and

C. Provide a visible status signal that indicates that the device is operating properly, or that it has failed or malfunctioned. The visible status signal may have an override that turns off the signal**.**

Exception to Section 110.9(b)4: Occupant sensing control systems may consist of a combination of single or multilevel occupant, motion or vacancy sensor controls, provided that components installed to comply with manual-on requirements shall not be capable of conversion by occupants from manual-on to automatic-on functionality.

5. Reserved**.**

6. **Sensors used to detect occupants.** Sensors that are used by occupant sensing controls to detect occupants shall meet all of the following requirements:

   A. Sensors shall not incorporate switches or mechanical devices that allow the sensor to be disabled without changing the settings of the control.

   B. Sensors that utilize ultrasonic radiation for detection of occupants shall:

      i. comply with 21 C.F.R. part 1002.12;

      ii. not emit audible sound; and

      iii. not emit ultrasound in excess of the decibel levels shown in Table 110.9-A measured no more than 5 feet from the source, on axis.

   C. Sensors that utilize microwave radiation for detection of occupants shall:

      i. comply with 47 C.F.R. parts 2 and 15; and

      ii. not emit radiation in excess of 1 milliwatt per square centimeter measured at no more than 5 centimeters from the emission surface of the device.

7. **Indicator lights.** Indicator lights integral to lighting controls shall consume no more than 1 watt of power per indicator light.

«» Commentary for Section 110.9(b):

All installed lighting control devices and systems for multifamily indoor lighting (i.e. lighting installed in common areas and dwellings), parking lot lighting, and outdoor lighting must meet the functionality requirements in Section 110.9(b).

These lighting controls requirements are used to ensure that the controlled lighting is not operating unnecessarily with the automatic controls enabled – for example, the controlled lighting are switched off (with time switch controls or astronomical time-switch controls) during the daytime when there is daylight available or the controlled lighting is switched off (through occupancy or motion sensors) when there is nobody in the nearby area that will benefit from the lighting.

Additionally, there is a dimming requirement that is intended to allow for several different strategies. This includes matching the output of the lighting system to the

design criteria to avoid over-lighting and using occupancy sensor or time switch driven "high-low" operation that will provide minimal lighting in low occupancy periods but still be able to operate at the proper level when an occupant is detected.

This section stipulates minimum performance requirements for installed lighting control devices and systems for the types specified in Section 110.9. The devices or the systems must be able to turn off or dim the lighting in a manner that ensures normal operation of the lighting system with the controls as an effective and reliable method to ensure energy conservation. For this reason, the section stipulates capabilities that may be minimum or maximum values, depending on the circumstances, and also details certain functional or process requirements in the devices to help avoid users in the building overriding or disabling the controls. **«»**

(c) Track lighting integral current limiter. An integral current limiter for line-voltage track lighting shall be recognized for compliance with Part 6 only if it meets all of the following requirements:

1. Shall have the identical volt-ampere (VA) rating of the current limiter as installed and rated for compliance with Part 6 clearly marked as follows:
   A. So that it is visible for the enforcement agency's field inspection without opening coverplates, fixtures or panels; and
   B. Permanently marked on the circuit breaker; and
   C. On a factory-printed label that is permanently affixed to a nonremovable base-plate inside the wiring compartment.
2. Shall have a conspicuous factory installed label permanently affixed to the inside of the wiring compartment warning against removing, tampering with, rewiring or bypassing the device; and
3. Each electrical panel from which track lighting integral current limiters are energized shall have a factory printed label permanently affixed and prominently located, stating the following: "NOTICE: Current limiting devices installed in track lighting integral current limiters connected to this panel shall only be replaced with the same or lower amperage. Adding track or replacement of existing current limiters with higher continuous ampere rating will void the track lighting integral current limiter certification, and will require resubmittal of compliance documentation to the enforcement agency responsible for compliance with the California Title 24, Part 6 Building Energy Efficiency Standards."

«» Commentary for Section 110.9(c)3:

A track lighting current limiter limits the power that can go through a section of track lighting. Without the current limiter, the "installed" wattage of a long section of track could be excessive and use up the allotted lighting power for a space. With track lighting and a current limiter, the track heads can be placed anywhere along the run of

the track as long as the total wattage of all heads on the track stays below the rated wattage of the current limiter. If the wattage exceeds the rated wattage of the current limiter, the limiter turns off current to the controlled lighting.

The current limiter requirement addresses two possible issues.

1. A track with too many heads that produce over lighting and likelihood of a dangerous overload, and
2. A long track with very few heads. **«»**

(d) Track lighting supplementary overcurrent protection panel. A Track Lighting Supplementary Overcurrent Protection Panel shall be used only for line-voltage track lighting and shall be recognized for compliance with Part 6 only if it meets all of the following requirements:

1. Shall be listed as defined in Section 100.1; and
2. Shall have a permanently installed label that is prominently located stating the following: "NOTICE: This Panel for Track Lighting Energy Code Compliance Only." The overcurrent protection devices in this panel shall only be replaced with the same or lower amperage. No other overcurrent protective device shall be added to this panel. Adding to, or replacement of, existing overcurrent protective device(s) with higher continuous ampere rating will void the panel listing and require resubmittal of compliance documentation to the enforcement agency responsible for compliance with the California Title 24, Part 6 Building Energy Efficiency Standards.

«» Commentary for Section 110.9(d)2:

A track lighting supplementary overcurrent protection panel is a subpanel that contains current limiters for use with multiple track lighting circuits only. A track lighting supplementary overcurrent protection panel shall be used only for line-voltage track lighting.

This requirement addresses the same issues as above, but from a remote location.**«»**

TABLE 110.9-A - ULTRASOUND MAXIMUM DECIBEL VALUES

MID-FREQUENCY OF SOUND PRESSURE THIRD-OCTAVE BAND (IN kHz)	**MAXIMUM DB LEVEL WITHIN THIRD-OCTAVE BAND (IN dB REFERENCE 20 MICROPASCALS)**
Less than 20	80
20 or more to less than 25	105
25 or more to less than 31.5	110
31.5 or more	115

SECTION 110.11 – MANDATORY REQUIREMENTS FOR ELECTRICAL POWER DISTRIBUTION SYSTEM

Certification by Manufacturers. Any electrical power distribution system equipment listed in this section may be installed only if the manufacture has certified to the Commission that the equipment complies with all the applicable requirements of this section.

(a) Low-voltage dry-type distribution transformer shall be certified by the Manufacturer as required by the Title 20 Appliance Efficiency Regulations.

EXCEPTION to Section 110.11(a):

1. autotransformer;
2. drive (isolation) transformer;
3. grounding transformer;
4. machine-tool (control) transformer;
5. nonventilated transformer;
6. rectifier transformer;
7. regulating transformer;
8. sealed transformer;
9. special-impedance transformer;
10. testing transformer;
11. transformer with tap range of 20 percent or more;
12. uninterruptible power supply transformer; or
13. welding transformer.

SECTION 110.12 – MANDATORY REQUIREMENTS FOR DEMAND MANAGEMENT

Buildings, other than healthcare facilities, that install or are required to install demand responsive controls shall comply with the applicable demand responsive control requirements of Sections 110.12(a) through 110.12(e).

(a) Demand responsive controls.

1. All demand responsive controls shall be either:
   A. A certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN), as specified under Clause 11, Conformance, in the applicable OpenADR 2.0 Specification; or a certified Baseline Profile OpenADR 3.0 Virtual End Node; or
   B. Certified to the Energy Commission as being capable of responding to a demand response signal from a certified OpenADR 2.0b or a certified Baseline Profile OpenADR 3.0 Virtual End Node by automatically implementing the control functions requested by the Virtual End Node for the equipment it controls.
2. All demand responsive controls shall be capable of communicating with the VEN using a wired or wireless bidirectional communication protocol.
3. RESERVED
4. When the demand response signal is disabled or unavailable, all demand responsive controls shall continue to perform all other control functions provided by the control.

«» Commentary for Section 110.12(a)4:

Demand response is an increasingly important function of buildings as distributed energy resources become more common and customers have access to time of use electricity rates and incentive programs designed to encourage demand side optimization. Demand response occurs on a range of timescales, from seconds to seasons, and represents any demand change in response to grid or economic needs. In addition to existing time of use electricity rates, utilities in the future will likely connect electricity costs to high frequency fluctuations in both the supply and demand for electricity. Appropriate demand responsive controls allow building operators to maintain the quality of services a building provides and reduce the total cost of energy by automating a building's response to changes in electricity rates.

Communication with Entity that Initiates DR Signal

The demand responsive (DR) control system must be able to communicate with the entity that initiates a DR signal by way of an OpenADR certified virtual end node (VEN).

The OpenADR 2.0 protocol is the primary open-standard protocol used in the California market. It implements a profile within the Organization of Structured Information Standards (OASIS) Energy Interoperation information and communication model that defines two types of communications entities – virtual top nodes (VTNs) and virtual end nodes (VENs). VTNs are either physical or cloud based information exchange servers, typically operated by utilities or third-party providers, that transmit events or price information. VENs are the hardware that receive the data transmitted by a VTN, and are typically the gateway or end-use devices installed at customer facilities. See OpenADR Alliance's website (http://www.openadr.org/) for more information about OpenADR certified VENs.

Certification Requirements for Demand Response Controls

The Energy Code has certification requirements for demand responsive controls in Section 110.12(a).

Option A:

Install an OpenADR 2.0a or 2.0b certified VEN or a certified Baseline Profile OpenADR 3.0 VEN physically within the building as part of the DR control system (Section 110.12(a)1A)

For demand-responsive controls that comply according to Section 110.12(a)1A, the certified OpenADR 2.0 Virtual End Node (VEN) or certified Baseline Profile OpeADR 3.0 VEN can be incorporated into a networked system of devices allowing the VEN to communicate with multiple devices in the network. Alternatively, each demand-responsive control device in the building could be a certified VEN. Devices downstream of the certified OpenADR VEN do not need to be certified to Section 110.12(a)1. The OpenADR VEN must be installed on-site as part of the demand-responsive control system and at time of inspection.

Option B:

Install a demand response (DR) control system that has been certified to the Energy Commission as being capable of communicating with an OpenADR 2.0b certified VEN (Section 110.12(a)1B)

For demand-responsive controls that comply according to Section 110.12(a)1B, the demand responsive control system must be certified to the CEC as being capable of automatically responding to a certified OpenADR 2.0b VEN or a certified Baseline Profile OpenADR 3.0 VEN. The VEN may be separately located on-site, off-site, or in the cloud, and is not required to be in operation at the time of permitting. The demand-responsive

control must be programmed or configured so any test control strategy defined in the building code can be deployed at the time of permitting.

The 2025 Energy Code Section 110.12(a)2 requires that all demand-responsive controls must be capable of communicating with the VEN using a wired or wireless bidirectional communication pathway. The communication pathway to the VEN must be installed or established to comply.

A list of demand-responsive controls certified to the Energy Commission can be found at the Energy Commission website, https://www.energy.ca.gov/rules-and-regulations/building-energy-efficiency/manufacturer-certification-building-equipment/dr-controls-lighting. **«»**

(c) Demand Responsive Lighting Controls. Buildings with nonresidential lighting systems having a total installed lighting power of 4,000 watts or greater that are subject to the requirements of Section 130.1(b) or 160.5(b)4B shall install controls that are capable of automatically reducing lighting power in response to a demand response signal.

1. For compliance testing, the lighting controls shall demonstrate a 15-percent or greater reduction in lighting power as described in NA7.6.3. The controls may provide additional demand responsive functions or abilities.
2. For buildings where demand response controls are required, demand responsive controls shall control the general lighting in the spaces required to meet Section 130.1(b) or 160.5(b)4B.
3. General lighting shall be reduced in a manner consistent with the requirements of Section 130.1(b) or 160.5(b)4B.

Exception to Section 110.12(c): Spaces where a health or life safety statute, ordinance, or regulation does not permit the general lighting to be reduced are not required to install demand responsive controls and do not count toward the 4,000-watt threshold.

«» Commentary for Section 110.12(c)3:

Multifamily buildings with general lighting systems in the common use areas having a total installed lighting power of 4,000 watts or greater that are subject to the multilevel requirements in Section 160.5(b)4B must meet demand-responsive lighting control requirements. Lighting in the dwelling units or controlled through the dwelling units (e.g. outdoor porch or deck lighting) is excluded from the calculation of total building lighting power.

The demand-responsive control must be capable of reducing the total lighting power by 15 percent or greater. The lighting power reduction must meet the uniformity requirements of Section 160.5(b)4B.

Note that these requirements are focused on a temporary light level reduction and not on the long-term reduction of lighting. Only the general lighting is required to be connected to the DR controls, however any additional lighting (accent, decorative, etc.) can be connected to the controls as well. The general lighting in the common use areas is the basis for the reduction.

This DR capability must be applied in habitable spaces only; other spaces are less likely to have the lights turned 'On' at any given time due to the occupancy sensors and the DR benefit comes from the lighting systems that are normally operating when a DR event occurs. **«»**

(d) Demand Responsive Electronic Message Center Control. Controls for electronic message centers greater than 15 kW shall be capable of reducing the lighting power by a minimum of 30 percent when receiving a demand response signal.

Exception to Section 110.12(d): Electronic message centers that are not permitted by a health or life safety statute, ordinance, or regulation to be reduced.

(e) Demand Responsive Controlled Receptacles. In spaces required to have controlled receptacles per Section 130.5(d) or 160.6(d) and where demand responsive lighting controls are installed, the controlled receptacles shall be capable of automatically turning off all connected loads in response to a demand response signal.

Exception to Section 110.12(e): Spaces where a health or life safety statute, ordinance or regulation does not permit the receptacles to be automatically controlled.

«» Commentary for Section 110.12(e):

The common use areas in a multifamily building that are required to have demand responsive receptacles per Section 160.6(d) will have a circuit or circuits that are connected to a relay that is driven by the DR responsive lighting control system. This requirement is intended to be used for discretionary plug loads that can be turned 'Off' when a DR event occurs and should not be used for other devices that would have problems when turned 'Off' without following a shutdown procedure.

This DR receptacles requirement follows with the controlled receptacles requirement in Section 160.6(d) and adds an additional stipulation that if the building must have DR capability, then any of the controlled receptacles must also be connected to take the DR signal to temporarily turn 'Off' the outlets. **«»**

SECTION 160.5 – MANDATORY LIGHTING REQUIREMENTS FOR INDOOR AND OUTDOOR SPACES

The design and installation of all lighting systems and equipment in multifamily buildings within the scope of Section 100.0(a) shall comply with the applicable provisions of Section 160.5. All functional areas except dwelling units and common living areas shall comply with the applicable requirements of Sections 160.5(b) through 160.5(e).

(a) Dwelling unit lighting.

The design and installation of all lighting systems and equipment in multifamily dwelling units shall comply with Section 160.5(a). Multifamily dwelling units include dormitory and senior housing dwelling accommodations. Outdoor lighting attached to multifamily buildings and controlled from the inside of a dwelling unit shall comply with the lighting requirements of Section 160.5(a).

1. Luminaire requirements

   A**. Luminaire efficacy**. All installed luminaires and light sources shall comply with Reference Joint Appendix JA8 and shall be certified and marked as required by JA8.

   Exception 1 to Section 160.5(a)1A: **Integrated device lighting:** Lighting integral to exhaust fans, kitchen range hoods, bath vanity mirrors, garage door openers, and ceiling fan kits that are subject to DOE's Appliance and Equipment Standards Program.

   Exception 2 to Section 160.5(a)1A: Navigation lighting rated less than five watts, such as night lights, step lights, and path lights.

   Exception 3 to Section 160.5(a)1A: Lighting with an efficacy of 45 lumens per watt or greater and located internal to drawers, cabinetry, and linen closets.

   Exception 4 to Section 160.5(a)1A: Light sources as follows:

   i. LED light sources installed outdoors;

   ii. inseparable solid state lighting (SSL) luminaires containing colored light sources that are installed to provide decorative lighting;

   iii. High intensity discharge (HID) light sources including pulse start metal halide and high pressure sodium light sources; and

iv. Luminaires with hardwired high frequency generator and induction lamp.

B. Reserved.

«» Commentary for Section 160.5(a)1:

For dwelling unit lighting, the Energy Code requires all permanently installed luminaires to be high luminous efficacy, as specified in Reference Joint Appendix JA8. Permanently installed lighting is defined in Section 100.1 and includes:

1. Lighting attached to walls, ceilings, or columns
2. Track and flexible lighting systems
3. Lighting inside permanently installed cabinets
4. Lighting attached to the top or bottom of permanently installed cabinets.
5. Lighting attached to ceiling fans
6. Lighting integral to exhaust fans
7. Lighting integral to garage door openers if it is switched independently from the garage door opener and does not automatically turn off after a pre-determined amount of time

Note that even if a luminaire is connected to power through a receptacle, if it is mounted on permanently installed cabinets or other objects, it must meet the high efficacy requirements in JA8.

The following are examples of non-permanently installed lighting:

1. Portable lighting as defined by Section 100.1 (including, but not limited to, table and freestanding floor lamps with plug-in connections)
2. Lighting installed by the manufacturer in appliances, or kitchen exhaust hoods in the dwelling unit

Luminaires not listed as exceptions to Section 160.5(a)1A must have an integral light source or removable lamp that meets the performance requirements of JA8. In addition to setting minimum efficacy requirements (lumens/Watt), JA8 establishes performance requirements that ensure accurate color rendition, dimmability, and reduced noise and flicker during operation.

Luminaires with integral sources, such as LED luminaires, must be certified to the Energy Commission as meeting the JA8 requirements. Luminaires that have changeable lamps (such as screw-base luminaires) must be installed with JA8-certified lamps.

Luminaires and lamps that are certified to the Energy Commission must be marked on the product as described in JA8. Lamps that will be installed in elevated temperature applications such as in enclosed luminaires must have a JA8-2025-E marking to indicate that the product has passed the more stringent federal test conducted at elevated temperature.

Luminaires that can be classified as high luminous efficacy by meeting the requirements of JA8 include:

1. LED luminaires with integral light sources that are certified to the Energy Commission.
2. Ceiling recessed downlight luminaires with JA8 certified light sources (the luminaire must not contain screw-based lamp sockets).
3. Screw-based luminaires with JA8-certified lamps.
4. Low-voltage pin-based luminaires with JA8-certified lamps.

Almost any luminaire can be classified as high luminous efficacy, as long as the luminaire is installed with a JA8 certified lamp or light source. The exception is recessed downlight luminaires in ceilings, which must meet additional requirements as detailed in the commentary below.

The Energy Commission maintains a database of certified JA8 certified luminaires, lamps, and light sources https://www.energy.ca.gov/programs-and-topics/programs/appliance-efficiency-program-outreach-and-education/modernized. The database can be accessed using a Quick Search Tool or an Advanced Search. **«»**

C. **Recessed downlight luminaires**. In addition to complying with Section 160.5(a)1A, luminaires recessed into ceilings shall meet all of the following requirements:

i. Shall not contain screw base lamp sockets; and

ii. Have a label that certifies the luminaire is airtight with air leakage less than 2.0 cfm at 75 Pascals when tested in accordance with ASTM E283. An exhaust fan housing with integral light shall not be required to be certified airtight; and

iii. Be sealed with a gasket or caulk between the luminaire housing and ceiling, and have all air leak paths between conditioned and unconditioned spaces sealed with a gasket or caulk, or be installed per manufacturer's instructions to maintain airtightness between the luminaire housing and ceiling; and

iv. Meet the clearance and installation requirements of California Electrical Code Article 410.116 for recessed luminaires.

Exception to Section 160.5(a)1Cii and Iii: Recessed luminaires marked for use in fire-rated installations, and recessed luminaires installed in noninsulated ceilings.

«» Commentary for Section 160.5(a)1C:

All recessed downlight luminaires must contain a light source or lamp that is JA8-certified, such as an integral LED source or LED lamp. Screw-based lamps such as LED A-lamps or LED PAR lamps are not allowed. Pin-based lamps such as LED MR-16 lamps are allowed in recessed luminaires as long as they are JA8-certified.

In addition to the light source and lamp requirements listed, recessed downlight luminaires in ceilings must meet all the following requirements.

1. Have a label that certifies the luminaire is airtight with air leakage less than 2.0 cubic ft. per minute at 75 Pascals when tested in accordance with ASTM E283 (exhaust fan housings with integral lighting are not required to be certified airtight).
2. Be sealed with a gasket or caulk between the luminaire housing and ceiling, and have all air leak paths between conditioned and unconditioned spaces sealed with a gasket or caulk, or be installed per manufacturer's instructions to maintain airtightness between the luminaire housing and ceiling.
3. Meet the clearance and installation requirements of California Electrical Code Article 410.116 for recessed luminaires which requires the following.
4. A recessed luminaire that is not identified for contact with insulation (non-Type IC), must have all recessed parts spaced not less than 1/2 inch from combustible

materials. The points of support and the trim finishing off the openings in the ceiling must be permitted to be in contact with combustible materials.

5. A recessed luminaire that is identified for contact with insulation (Type IC), must be permitted to be in contact with combustible materials at recessed parts, points of support, and portions passing through or finishing off the opening in the building structure.
6. Thermal insulation must not be installed above a recessed luminaire or within 3 inches of the recessed luminaire's enclosure, wiring compartment, ballast, transformer, LED driver, or power supply unless the luminaire is identified as Type IC for insulation contact.

Luminaires that meet the air leakage requirement or luminaires that are Type IC rated will have this information listed on luminaire cut sheets or packaging. Contractors are responsible for ensuring that luminaires are properly sealed to prevent air leakage between the luminaire housing and ceiling.

The air leakage requirements are to ensure there isn't substantial energy loss through the ceiling penetration, resulting in higher energy consumption throughout the life of the luminaire. Most other luminaires in a dwelling unit do not penetrate the conditioned/unconditioned boundary, so there is much less attention to the conditions of manufacture and installation in the energy code.

Recessed luminaires that are marked for use in fire-rated installations and recessed luminaires installed in non-insulated ceilings are exempt from the air leakage requirement and sealing requirement. However, these luminaires must meet all other requirements for recessed luminaires. **«»**

D. **Light sources in enclosed or recessed luminaires**. Lamps and other separable light sources in enclosed or recessed luminaires shall be in compliance with the JA8 elevated temperature requirements, including marking requirements.

E. **Blank electrical boxes**. The number of electrical boxes that are more than five feet above the finished floor and do not contain a luminaire or other device shall be no greater than the number of bedrooms. These electrical boxes shall be served by a dimmer, vacancy sensor control, low voltage wiring, or fan speed control.

2. **Indoor lighting controls**.

A. Lighting shall have readily accessible wall-mounted controls that allow the lighting to be manually turned ON and OFF.

Exception to Section 160.5(a)2A: Ceiling fans may provide control of integrated lighting via a remote control.

«» Commentary for Section 160.5(a)2A:

Per Section 100.1 Definitions, readily accessible is defined as "capable of being reached quickly for operation, repair, or inspection without requiring climbing or removing obstacles, or resorting to access equipment". Note that ceiling fans with pull chains do not meet the definition of "readily accessible". **«»**

B. Reserved.

C. **All lighting controls**. Lighting controls shall comply with the applicable requirements of Section 110.9.

D. **Controls permitted**. An energy management control system (EMCS) or a multi-scene programmable controller may be used to comply with dimming, occupancy and lighting control requirements in Section 160.5(a)2 if it provides the functionality of the specified controls in accordance with Section 110.9 and the physical controls specified in Section 160.5(a)2A. No controls shall bypass control functions of a dimmer, occupant sensor, or vacancy sensor where the dimmer or sensor has been installed to comply with Sectt«» Commentary for Section 160.5(a)2D:tA lighting circuit can be controlled by more than one switch, such as by three-way or four-way switches. For a lighting circuit with multiple switches, and where a dimmer or vacancy sensor has been installed to comply with Section 160.5(a), the following requirements must be met:tNo controls must bypass the dimmer or vacancy sensor function.

1. The dimmer or vacancy sensor must comply with the applicable requirements of Section 110.9(b). **«»**

E. **Automatic-off controls**.

i. In bathrooms, garages, laundry rooms, utility rooms and walk-in closets, at least one installed luminaire shall be controlled by an occupancy or vacancy sensor providing automatic-off functionality.

ii. For lighting internal to drawers and cabinetry with opaque fronts or doors, controls that turn the lighting off when the drawer or door is closed shall be provided.

F. **Dimming controls**. Lighting in habitable spaces, including living rooms, dining rooms, kitchens and bedrooms, shall have readily accessible wall-mounted dimming controls that allow the lighting to be manually adjusted up and down. Forward phase cut dimmers controlling LED light sources shall comply with NEMA SSL 7A.

Exception 1 to Section 160.5(a)2F: Ceiling fans may provide control of integrated lighting via a remote control. Lighting integral to kitchen range hoods and bathroom exhaust fans.

Exception 2 to Section 160.5(a)2F: Luminaires controlled by an occupancy or vacancy sensor providing automatic-off functionality.
Exception 3 to Section 160.5(a)2F: Navigation lighting rated less than five watts**,** such as night lights, step lights and path lights. Lighting controlled by automatic-off controls and located internal to drawers, cabinetry with opaque fronts, or cabinetry with doors.

«» Commentary for Section 160.5(a)2F:

Forward phase cut dimmers controlling LED light sources in these spaces must comply with NEMA SSL 7A. The combined use of a NEMA SSL-7A-compliant dimmer with LED luminaires can ensure flicker free operation when the luminaire is dimmed. This dimmer/light source compatibility information is included in dimmer cut sheets or dimmer product packaging.

Lighting integral to appliances including kitchen range hoods and exhaust fans are not required to be provided with dimming controls. **«»**

G. **Independent controls**. Lighting integrated with the exhaust fans shall be controlled independently from the fans. The following shall be controlled separately from ceiling-installed lighting such that one can be turned on without turning on the other:

i. Undercabinet lighting

ii. Undershelf lighting

iii. Interior lighting of display cabinets

iv. Switched outlets

3. **Outdoor lighting controls.** In addition to meeting the requirements of Section 160.5(a)1, luminaires providing residential outdoor lighting shall meet the following requirements, as applicable:

A. Outdoor lighting attached to a building and separately controlled from the inside of a dwelling unit shall meet the following requirements:

i. Controlled by a manual ON and OFF control switch that permits the automatic actions of Item ii or iii below; and

ii. Controlled by one of the following controls:

a. a photocell and a motion sensor; or

b. a photocell and an automatic time switch control; or

iii. Controlled by an astronomical time clock control.

B. Controls that override to ON shall not be allowed unless the override automatically returns the automatic control to its normal operation within six hours.

C. An energy management control system (EMCS) or other controls that provides the specified lighting control functionality and complies with all requirements applicable to the specified controls may be used to meet these requirements.

«» Commentary for Section 160.5(a)3C:

All lighting permanently attached to the building or to other buildings on the same lot are subject to the dwelling unit outdoor lighting requirements if controlled from within a dwelling unit. This includes lighting for patios, entrances, balconies, and porches. Any outdoor lighting attached to a building that is not controlled from within a dwelling unit must meet the common use outdoor lighting requirements.

Decorative landscape lighting that is controlled from within a dwelling unit is not regulated by the multifamily lighting requirements. **«»**

(b) Common services area lighting. Lighting systems and equipment in multifamily common services areas shall comply with the applicable provisions of Sections 160.5(b)1 through 160.5(b)4.

Exception to Section 160.5(b): Lighting systems in common use areas providing shared provisions for living, eating, cooking or sanitation to dwelling units that would otherwise lack these provisions may instead comply with Section 160.5(a).

Note: The requirements of Section 160.5(b) apply to newly constructed buildings. Sections 180.1 and 180.2 specify which requirements of Sections 160.5(b)1 through 160.5(e) also apply to additions and alterations to existing buildings.

«» Commentary for Section 160.5(b):

The Energy Code requires that common service area lighting power is within a specified wattage budget, and that lighting controls are installed for the efficient operation of installed lighting.

In addition to meeting all mandatory requirements, design teams can choose between prescriptive and performance compliance approaches. **«»**

1. **Luminaire classification and power**. Luminaires shall be classified, and their wattage determined as follows:

   A. Luminaire wattage shall be labeled as follows:

      i. The maximum rated wattage or relamping rated wattage of a luminaire shall be listed on a permanent, preprinted, factory-installed label, as specified by UL 1574, 1598, 2108 or 8750, as applicable; and

ii. The factory-installed maximum rated wattage or relamping rated wattage label shall not consist of peel-off or peel-down layers or other methods that allow the rated wattage to be changed after the luminaire has been shipped from the manufacturer.

Exception to Section 160.5(b)1Aii: Luminaires with a single lamp and an integrated ballast or transformer may use a peel-down label provided that they are layered such that the rated wattage reduces as successive layers are removed.

a. Low-voltage luminaires (except low voltage track systems), ≤ 24 volts, with a maximum relamping rated wattage of 50 watts.

b. Compact fluorescent luminaires, having an integral electronic ballast, with a maximum relamping rated wattage of 42 watts.

c. High intensity discharge luminaires, having an integral electronic ballast, with a maximum relamping rated wattage of 150 watts.

B. For luminaires with line voltage lamps not served by drivers, ballasts or transformers, the wattage of such luminaires shall be determined as the maximum rated wattage as labeled in accordance with Section 160.5(b)1A.

«» Commentary for Section 160.5(b)1B:

Figure 6-4: Examples of Luminaires With Line-Voltage Lamp Holders

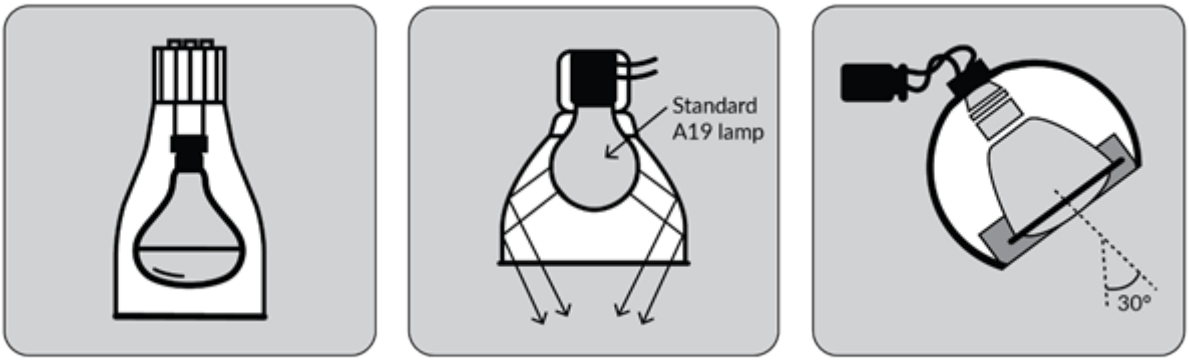


Image Source: Energy Solutions

In common use areas, luminaires with line voltage lamp holders may be acceptable, but the wattage of the luminaires is based on the maximum rated wattage as labeled, not on the wattage of the lamp installed in the luminaire. The maximum rated wattage will determine how many luminaires can be used based on the lighting power allowances for the type of space. **«»**

C. For luminaires with permanently installed or remotely installed ballasts, the wattage of such luminaires shall be the operating input wattage of the rated

lamp/ballast combination published in the ballast manufacturer's catalogs based on independent testing lab reports as specified by UL 1598.

D. For inseparable SSL luminaires and SSL luminaires with remotely mounted drivers, the maximum rated wattage shall be the maximum rated input wattage of the SSL luminaire as specified in Section 160.5(b)1A when tested in accordance with UL 1598, 2108 or 8750, or IES LM-79.

«» Commentary for Section 160.5(b)1D:

Figure 6-5: Examples of SSL Luminaires: Recessed Downlight Luminaires

Image Source: Lutron Electronics Co., Inc.

«»

E. For LED tape lighting and LED linear lighting with LED tape lighting components, the maximum rated wattage shall be the sum of the installed length of the tape lighting times its rated linear power density in watts per linear foot, or the maximum rated input wattage of the driver or power supply providing power to the lighting system, with tape lighting tested in accordance with UL 2108 or 8750, or IES LM-79.

«» Commentary for Section 160.5(b)1E:

Figure 6-6 Examples of LED Tape Lighting

Source: NORA Lighting

The LED tape light products are not specifically matched to an LED driver but the driver does have a maximum wattage rating that will limit the length of LED tape light installed upon it. Section 160.5(b)1E indicates that the LED driver full wattage does not have to be the wattage used in the lighting power density (LPD) calculations because the actual energy consumption for the strip lights will be dependent on how long the tape light segments are and how many watts per foot the tape light product consumes at full output.

In many cases, designers will use a larger driver than the total LED tape light requires to ensure the driver isn't being operated too close to full output all the time, or because there is no driver that perfectly matches the wattage requirements of the tape light. In this circumstance, the designer is permitted to use the wattage per foot of the tape light multiplied by the total length of the tape light instead of the full LED driver rating. **«»**

F. For modular lighting systems that allow the addition or relocation of luminaires without altering the wiring of the system, wattage shall be determined as follows:

   i. The wattage shall be the greater of:

      a. 30 watts per linear foot of track or plug-in busway; or

      b. the rated wattage of all of the luminaires included in the system, where the luminaire wattage is determined as specified in Section 160.5(b)1A; or

   ii. For line-voltage lighting track and plug-in busway served by a track lighting integral current limiter or a dedicated track lighting supplementary overcurrent protection panel, the wattage shall be determined as follows:

      a. The volt-ampere rating of current limiter as specified by UL 1077; or

      b. The sum of the ampere (A) rating of all of the current protection devices times the branch circuit voltages for track lighting supplementary overcurrent protection panel.

   iii. For other modular lighting systems with power supplied by a driver, power supply or transformer, including but not limited to low-voltage lighting systems, the wattage of the system shall be the maximum rated input wattage of the driver, power supply or transformer published in the manufacturer's catalogs, as specified by UL 2108 or 8750.

   Exception to Section 160.5(b)1F: For power-over-Ethernet lighting systems, power provided to installed nonlighting devices may be subtracted from the total power rating of the power-over-Ethernet system.

«» Commentary for Section 160.5(b)1F:

Track lighting is a highly-configurable lighting design approach and accounting for it in lighting power calculations can be complex. The lighting power calculations allow the

wattage calculation to be based on the sum of the wattages of all the track heads included for the system or for line-voltage track, by using the track current limiter rating. A PoE (power-over-Ethernet) lighting system provides low-voltage direct current and communications over Ethernet cabling. By contrast, most conventional lighting systems use alternating current to power luminaires.

Figure 6-7 A Track Lighting System

Image Source: California Energy Commission

Figure 6-8 A Track Lighting Installation

Image Source: Acuity Brands Lighting, Inc.

A PoE lighting system usually contains three main components — a powered device (PD), Ethernet cabling, and power sourcing equipment (PSE) such as Ethernet switches. PSE is a general term used for a PoE power supply.

PSEs supply power via Ethernet cabling to PDs, such as PoE luminaires.

Note that PoE lighting is different from the tape light application discussed above in that the wattage of this system must be based on the output of the PSE and not the actual lighting equipment connected to that power source. The exception is that any loads on the PSE that are not lighting equipment can be subtracted from the PSE rated wattage. **«»**

G. For all other lighting equipment not addressed by Sections 160.5(b)1B through F, the wattage of the lighting equipment shall be the maximum rated wattage of the lighting equipment, or operating input wattage of the system, labeled in accordance with Section 160.5(b)1A, or published in manufacturer's catalogs, based on independent testing lab reports as specified by UL 1574, 1598, 2108, 8750, or IES LM-79.

2. **Lighting controls**. All lighting controls and equipment shall comply with the applicable requirements in Sections 110.9, 160.5(b) and 160.5(c), and shall be installed in accordance with any applicable manufacturer instructions.

3. **Energy Management Control System (EMCS)**. An EMCS may be installed to comply with the requirements of one or more lighting controls if it meets the following minimum requirements:

   A. Provides all applicable functionality for each specific lighting control or system for which it is installed in accordance with Sections 110.9, 160.5(b) and 160.5(c); and

   B. Complies with all applicable lighting control installation requirements in accordance with Section 160.5(e) for each specific lighting control or system for which it is installed; and

   C. Complies with all applicable application requirements for each specific lighting control or system for which it is installed, in accordance with Part 6.

4. **Mandatory indoor lighting controls**. Multifamily common use areas shall comply with the applicable requirements of Sections 160.5(b)4A through 160.5(b)4F, in addition to the applicable requirements of Section 110.9.

   A. **Manual controls.** Each space shall be provided with lighting controls that allow the lighting in that space to be manually turned on and off. The manual control shall:

      i. Be readily accessible; and

      Exception to Section 160.5(b)4Ai: Restrooms having two or more stalls, parking areas, stairwells, corridors and spaces of the building intended for access or use by the public may use a manual control not accessible to unauthorized personnel.

ii. Be located in the same space, or be located such that the controlled lighting or the status of the controlled lighting can be seen when operating the controls; and

iii. Provide separate control of general, floor display, wall display, window display, case display, ornamental, and special effects lighting, such that each type of lighting can be turned on or off without turning on or off other types of lighting. Scene controllers may comply with this requirement provided that at least one scene turns on general lighting only, and the control provides a means to manually turn off all lighting.

«» Commentary for Section 160.5(b)4A:

Each multifamily common use area space shall have lighting controls that allow lighting in that area to be manually turned on and off. Manual area controls allow occupants to control the light while they are in the space.

General lighting (also known as ambient lighting) is electric lighting that provides a uniform level of illumination throughout an area exclusive of any provision for special visual tasks or decorative effect, or exclusive of daylighting. General lighting is the primary lighting resource for basic tasks in general office spaces, etc. and is intended to be supplemented by task lights for visually intensive tasks.

Typical luminaires used for general lighting are troffers (prismatic, parabolic, or indirect diffusers), pendants (direct, indirect, or direct/indirect), high bay, low bay, and "aisle-lighter" fixtures. General lighting does not include display lighting (typically using directional MR, PAR, flood, spot, or wall washers) or decorative lighting (such as drum fixtures, chandeliers, or projection lighting.)

Section 100.1 also defines decorative, display, task, and special effects lighting as follows:

1. Decorative lighting or luminaires are installed only for aesthetic purposes that do not serve as display lighting or general lighting. Decorative luminaires are chandeliers, sconces, lanterns, cove lighting, neon or cold cathode, theatrical projectors, moving lights, and light color panels, not providing general lighting or task lighting.
2. Display lighting is supplementary lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance required to highlight features, such as merchandise, sculpture, or artwork.
3. Task lighting is lighting directed to a specific surface or area providing illumination for visual tasks. Task lighting is not general lighting.
4. Special effects lighting is lighting installed to give off luminance instead of providing illuminance, which does not serve as general, task, or display lighting.

When there is only one lighting system type in a space, that system type will be treated as general lighting. Thus, light fixtures that might ordinarily be considered decorative or

display luminaires are considered general lighting luminaires if they are the only system type in a given enclosed space. Note that the allowances for lighting cannot be combined; if a lighting system is deemed to be a general lighting system, it cannot also include the lighting allowance for decorative lighting or other supplementary lighting systems in the calculation. General lighting must also be circuited independent of decorative and display lighting. **«»**

Exception to Section 160.5(b)4A: Up to 0.1 watts per square foot of indoor lighting may be continuously illuminated to allow for means of egress illumination consistent with California Building Code Section 1008. Egress lighting complying with this wattage limitation is not required to comply with manual area control requirements if:

i. The space is designated for means of egress on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1; and

ii. The egress lighting controls shall not be controllable by unauthorized personnel during a normal power failure.

B. **Multilevel lighting controls.** The general lighting of any space with a size of 100 square feet or larger and with a connected lighting load greater than 0.5 watts per square foot shall be provided with multilevel lighting controls. The multilevel lighting controls shall provide and enable continuous dimming from 100 percent to 10 percent or lower of lighting power.

Exception 1 to Section 160.5(b)4B: An indoor space that has only one luminaire.

Exception 2 to Section 160.5(b)4B: Restrooms.

Exception 3 to Section 160.5(b)4B: The general lighting with light source of HID and induction shall have a minimum of one control step between 30 and 70 percent of full rated power.

«» Commentary for Section 160.5(b)4B:

Multilevel lighting controls allow the lighting level to be adjusted to accommodate how a room is being used. **«»**

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

Exception to Section 160.5(b)4C: Continuous illumination of up to 0.1 watts per square foot of lighting is allowed to be in any area designated for egress within a building, provided that the area is indicated on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1. Lighting providing means of egress illumination, as defined in the

California Building Code, shall be configured to provide no less than the illumination required by California Building Code Section 1008 while in the partial-off mode.

i. All installed indoor lighting shall be equipped with controls that meet the following requirements:

   a. Shall be controlled with an occupant sensing control set at no more than a 20-minute time delay, automatic time-switch control, or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and

   b. Separate controls for the lighting on each floor, other than lighting in stairwells; and

   c. Separate control zones for a space enclosed by ceiling height partitions not exceeding 5,000 square feet;

   Exception 1 to Section 160.5(b)4Ci: Where the lighting is serving an area that is in continuous use, 24 hours per day/365 days per year.

   Exception 2 to Section 160.5(b)4Ci: Lighting complying with Section 160.5(b)4Cv or Section 160.5(b)4Cvic.

   Exception 3 to Section 160.5(b)4Ci: Electrical equipment rooms subject to Article 110.26(D) of the California Electrical Code.

   Exception 4 to Section 160.5(b)4Ci: Illumination provided by lighting equipment that is designated for emergency lighting, and intended to function in emergency mode only when normal power is absent.

ii. Countdown timer switches may be used to comply with the automatic shut-OFF control requirements in Section 160.5(b)4Ci only in closets less than 70 square feet. The maximum timer setting shall be 10 minutes for closets.

iii. If an automatic time-switch control is installed to comply with Section 160.5(b)4Ci, it shall incorporate a manual override lighting control that allows the lighting to remain on for no more than 2 hours when an override is initiated.

   Exception to Section 160.5(b)4Ciii: Areas where occupant sensing controls are installed.

iv. If an automatic time-switch control is installed to comply with Section 160.5(b)4Ci, it shall incorporate an automatic holiday "shut-OFF" feature that turns OFF all loads for at least 24 hours, and then resumes the normally scheduled operation.

Exception 1 to Section 160.5(b)4Civ: Automatic holiday shut-OFF features are not required in restaurants.

Exception 2 to Section 160.5(b)4Civ: Areas where occupant sensing controls are installed.

v. **Occupant sensing controls.** In offices 250 square feet or smaller, multipurpose rooms of less than 1,000 square feet, conference rooms, and restrooms, lighting shall be controlled with occupant sensing controls to automatically shut OFF all of the lighting in 20 minutes or less after the control zone is unoccupied.

In areas required by Section 160.5(b)4B to have multi-level lighting controls, the occupant sensing controls shall function either as:

a. a partial-ON occupant sensing control capable of automatically activating between 50 and 70 percent of controlled lighting power, or

b. a vacancy sensing control, where all lighting responds to a manual ON input only.

In areas not required by Section 160.5(b)4B to have multi-level lighting controls the occupant sensing controls shall function either as:

a. an automatic full-on occupant sensing control; or

b. a partial-ON occupant sensing control, or

c. a vacancy sensing control, where all lighting responds to a manual ON input only.

In addition, controls shall be provided that allow the lights to be manually shut OFF in accordance with Section 160.5(b)4A regardless of the sensor status.

«» Commentary for Section 160.5(b)4C:

Figure 6-9: Functional Diagram for Partial-ON Occupant Sensor

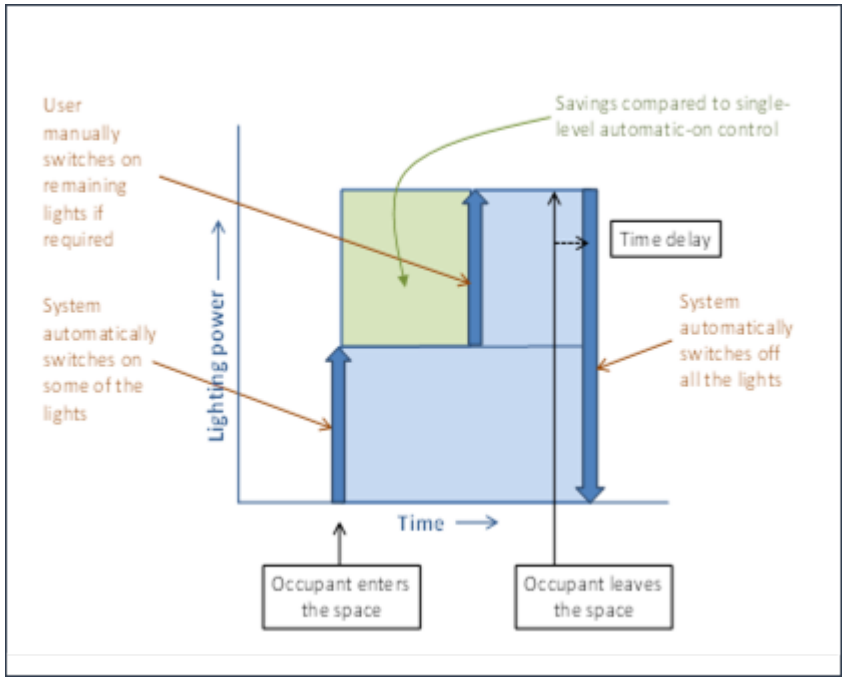


Image Source: California Energy Commission

Figure 6-9: Functional Diagram for Partial-ON Occupant Sensor illustrates the typical operation of a Partial-ON occupant sensor. A portion of the lighting automatically turns on when an occupant enters the space (illustrated by the lower blue rectangle), the occupant can manually turn on the rest of the lighting in the space when needed (the upper blue rectangle), and all of the lighting in the space automatically turns off when the space is no longer occupied. **«»**

vi. **Full or partial OFF occupant sensing controls.** For corridors, stairwells, and offices greater than 250 square feet, parking garages, parking areas, loading areas, and unloading areas, the installed lighting shall meet the following requirements:

a. In corridors and stairwells, lighting shall be controlled by occupant sensing controls that separately reduce the lighting power in each space by at least 50 percent when the space is unoccupied. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space and shall be automatically activated from all designed paths of egress.

b. In office spaces greater than 250 square feet, general lighting shall be controlled by occupancy sensing controls that meet all of the following:

I. The occupancy sensing controls shall be configured so that lighting shall be controlled separately in control zones not greater than 600 square feet. All control zones in offices greater than 250 square feet shall be shown on the plans; and

II. In 20 minutes or less after the control zone is unoccupied, the occupancy sensing controls shall uniformly reduce lighting power in the control zone to no more than 20 percent of full power. Control functions that switch control zone lights completely off when the zone is vacant meet this requirement; and

III. In 20 minutes or less after the entire office space is unoccupied, the occupancy sensing controls shall automatically turn off lighting in all control zones in the space; and

IV. In each control zone, lighting shall be allowed to automatically turn on to any level up to full power upon occupancy within the control zone. 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.

Exception to Section 160.5(b)4Cvib: Under-shelf or furniture-mounted task lighting controlled by a local switch and either a time switch or an occupancy sensor.

«» Commentary for Section 160.5(b)4Cvi:

All installed indoor lighting in multifamily common use areas shall be equipped with controls that are able to automatically reduce lighting power when the space is typically unoccupied.

Shut off controls can be used to automatically turn off or reduce lighting when the spaces are not occupied.

Offices larger than 250 sq. ft. are required to be equipped with an occupant sensing control that manages the general lighting and may also control HVAC thermostat setback and air flow (Section 160.5(b)4Cvib, Section 160.3(a)2D, Section 160.2(c)3, and Section 160.2(c)5E). The occupant sensing control for the space must be capable of signaling to the HVAC system the occupancy status of the space independent of the lighting load status.

Using the same occupancy sensors for the lighting and the HVAC system immediately alerts occupants if the occupancy sensors have failed, as the lights would turn off when the space is occupied. An occupancy sensor failure might not be as readily apparent if it controlled the HVAC system only. However, it is not a requirement that the lighting and HVAC systems be controlled by the same occupancy sensor. This method of controlling cooling, ventilation, and lighting satisfies the requirements of Section 160.3(a)2D, Section 160.2(c)5E, and Section 160.5(b)4Cvib, so no additional shut off controls are required in these spaces (except for lighting associated with the egress path, which may remain energized when the building is unoccupied).

Figure 6-10 (for Example 6-1): Occupant Sensing Control Zones for Office Spaces Greater Than 250 Square Feet

In office spaces greater than 250 sq. ft., the occupant sensing controls must be configured such that general lighting in the space is divided into separate control zones, and the size of each control zone must be 600 sq. ft. or less.

Figure 6-10 (for Example 6-1) An Office Plan With Occupant Sensing Control Zone Layout below provides an example of a 2,584 square foot office that meets this requirement. Display lighting and wall wash are omitted as they do not need to comply with this requirement. In this case, the office is divided into eight occupant sensing control zones, each controlled by an occupant sensor. The occupant sensors in this example have a circular coverage pattern with a radius of 13.5 feet, resulting in a coverage area of 573 square feet, which meets the 600 square feet or less per control zone requirement. Each circle in the image represents the coverage area of the occupant sensor located at the center of the circle. The evenly spaced purple rectangles represent 2’x4’ luminaires that provide general lighting in the office, and the luminaires within each circle are controlled by the occupant sensor at the center of the circle. If a luminaire is in two or more circles, it is controlled by the closest occupant sensor.

The size of each control zone is at the discretion of the practitioner, as long as it is not larger than 600 square feet. The control zones within the office space do not need to be equal in size. If each occupant sensing control zone in an office is 250 square feet or less and the prescriptive compliance path is used, consider taking advantage of the power adjustment factor (PAF) provided in Section 170.2(e)2B for occupant sensing controls in offices larger than 250 square feet. Refer to Table 170.2-L for more information on the PAF.

Figure 6-10 (for Example 6-1) An Office Plan With Occupant Sensing Control Zone Layout

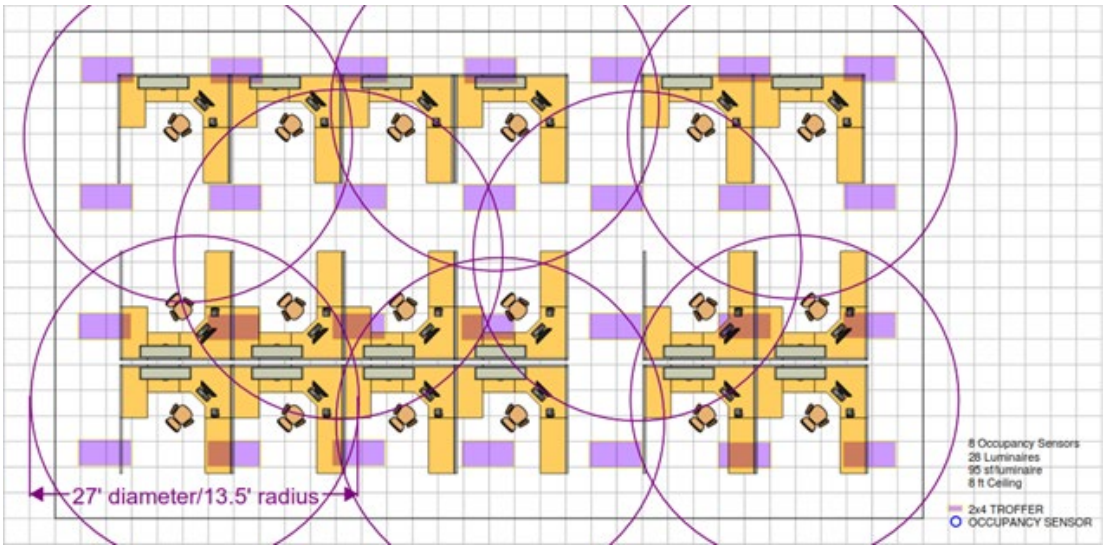


Image Source: Energy Solutions

Figure 6-11 (for Example 6-2): Occupant Sensing Control Zone in a Large Office Using Power Adjustment Factor

Figure 6-11 (for Example 6-2) An Office Plan With Occupant Sensing Control Zone Layout below shows another occupant sensing control zone design for the same 2,584 sq. ft. office. In this design, 15 occupant sensors are used to meet the requirement, and each sensor has a circular coverage pattern with a radius of 8.5 feet, resulting in a coverage area of 227 sq. ft. Because each sensor controls 227 sq. ft., which is less than 250 sq. ft. but more than 126 sq. ft., a PAF of 0.20 can be used per Table 170.2-L. Refer to Section 170.2(e)2B for detailed requirements on using the PAF for occupant sensing controls in offices larger than 250 square feet.

Note that using PAFs for occupant sensing controls is dependent on the square footage that each occupant sensor covers and not the number of occupant sensors used. For example, if each of the 15 occupant sensors in Figure 6-11 (for Example 6-2) An Office Plan With Occupant Sensing Control Zone Layout below had a coverage area greater than 250 sq. ft., the design would not qualify to use the PAF.

Figure 6-11 (for Example 6-2) An Office Plan With Occupant Sensing Control Zone Layout

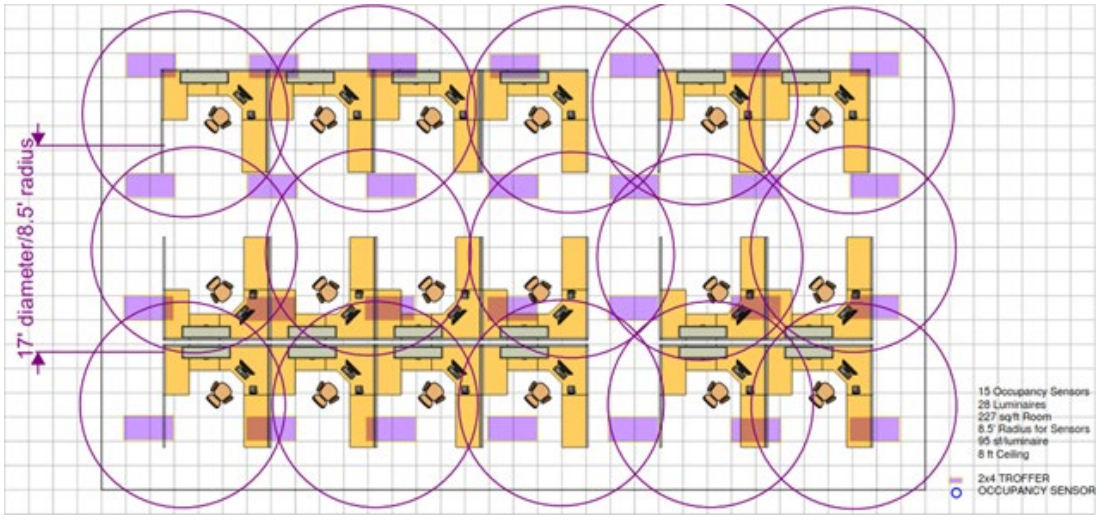


Image Source: Energy Solutions

Figure 6-12 (for Example 6-3): Occupant Sensing Control Zones for Luminaires With Integral Occupant Sensors

For luminaires with an integral occupant sensor that are capable of reducing power independently from other luminaires, each luminaire can be considered as its own control zone, and the size of the control zone equals the coverage area of the luminaire-integrated occupant sensor. This configuration is likely to result in occupant sensing control zones 250 sq. ft. or smaller. So, if using the prescriptive compliance path, consider taking advantage of the PAF provided in Section 170.2(e)2B for occupant sensing controls in offices larger than 250 square feet. Refer to Table 170.2-L for more about using the PAF.

Note that each luminaire with an integral occupant sensor can be considered as its own control zone only if they are commissioned to reduce power independently from other luminaires. Several lighting systems allow "grouping" luminaires with an integral occupant sensor. In such a grouping configuration, all luminaires within the group will operate to provide the designed task light level as long as one luminaire-integrated sensor detects occupancy. Similarly, all luminaires will reduce power to 20 percent or less only after no occupant is detected by any of the luminaire-integrated sensors within the group for 20 minutes. In this case, the total area covered by a group of luminaire-integrated occupant sensors is considered as a single occupant sensing control zone and shall be 600 square feet or less.

Figure 6-12 (for Example 6-3): An Office Plan With Occupant Sensing Control Zone Layout below provides an example of the same 2,584 sq. ft. office using luminaires with an integral occupant sensor, with each luminaire commissioned to reduce power independently from the other luminaires. In this case, there are 28 luminaires; therefore, there are 28 occupant sensing control zones. The coverage area of each sensor (and therefore the size of each control zone) is 100 sq. ft. This occupant sensing control zone design not only meets the control requirements but is eligible for a PAF of

0.30 since each occupant sensing control zone is less than 125 sq. ft. (see Table 170.2-L).

Figure 6-12 (for Example 6-3): An Office Plan With Occupant Sensing Control Zone Layout

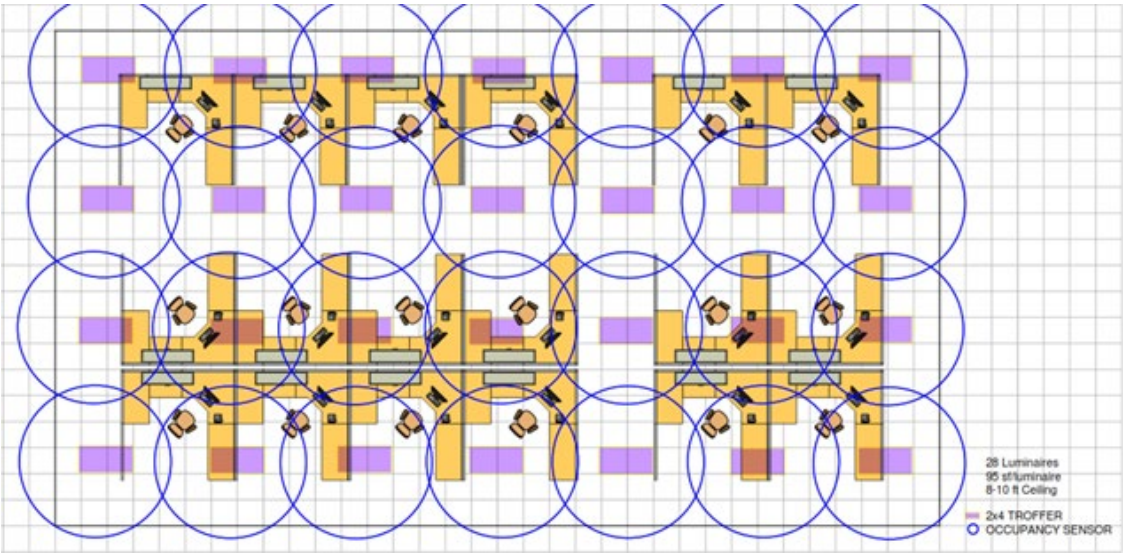


Image Source: Energy Solutions

Figure 6-13 (for Example 6-4): Occupant Sensing Controls for an Office Greater Than 250 Square Feet With a Single Control Zone

An office space larger than 250 sq. ft. but smaller than or equal to 600 sq. ft. may have a single control zone for the entire office as long as the field of view of the occupant sensor is able to cover the entire office. Figure 6-13 (for Example 6-4) An Office Plan With Occupant Sensing Control Zone Layout below shows a shared office space of 400 square feet as an example. In this case, a single occupant sensor is able to cover the entire office and, therefore, meets the requirement.

Figure 6-13 (for Example 6-4) An Office Plan With Occupant Sensing Control Zone Layout

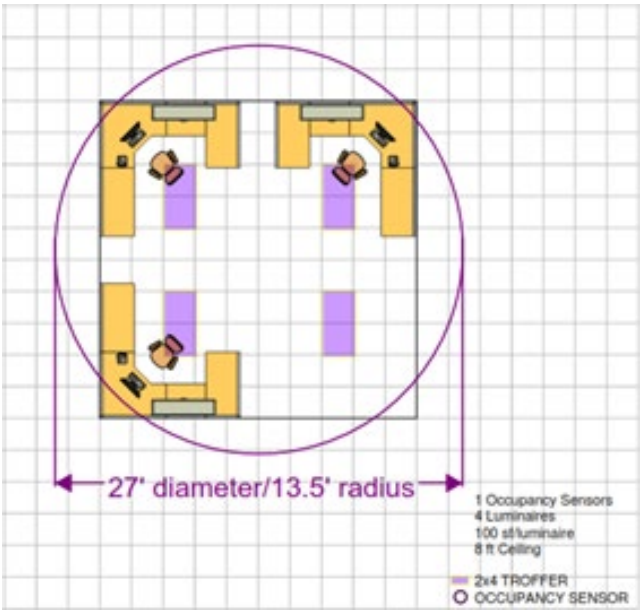


Image Source: Energy Solutions

«»

c. In parking garages, parking areas, and loading and unloading areas, general lighting shall be controlled by occupant sensing controls that meet the requirements below instead of complying with Section 160.5(b)4Ci:

   i. The occupant sensing controls shall uniformly reduce lighting power in the control zone to between 20 percent and 50 percent of full power and with at least one control step; and

   ii. No more than 500 watts of rated lighting power shall be controlled together as a single zone; and

   iii. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled zone and shall be automatically activated from all designed paths of egress.

   Interior areas of parking garages are under the classification of indoor lighting and shall comply with Section 160.5(b)4Cvic. Parking areas on the roof of a parking structure are under the classification of outdoor hardscape and shall comply with Section 160.5(c).

«» Commentary for Section 160.5(b)4Cvic:

For the spaces described in Section 160.5(b)4Cvic, lighting power must be reduced by at least 50 percent of the design lighting power, and the lighting must be reduced while maintaining similar levels of uniformity to the full power conditions. The zoning of the controls requires careful consideration of paths of egress to ensure that the sensor

coverage in the zone is adequate. The wattage limits per zone will typically not permit entire floors of a garage to be on a single zone.

Regardless of the wattage limits, the sensors must cover the full area of the controlled lighting to ensure there are no dead zones in the sensors that will cause the system to not respond appropriately.

Interior areas of parking garages are classified as indoor lighting for compliance with Section 160.5(b)4Cvic.

The parking areas on the roof of a parking structure are classified as outdoor hardscape and shall comply with the applicable provisions in Section 160.5(c). Controls requirements in Section 160.5(b)4Cvic do not apply to open rooftop parking.

A partial off lighting control system as shown in Figure 6-14 Functional Diagram for Partial Off Occupant Sensor commonly employed in spaces in a building that are public and not 'owned' by an individual or several people such that they would have manual override controls.

This design approach is often used for corridors and lobbies inside the building and in parking garages. After normal hours, the lighting will be 'Off' but will respond to an occupancy event, but during normal hours, it will operate in a 'Partial-on' level until an occupancy event, where it will rise up to the 'occupied' level, which may be fully 'On'.

Figure 6-14 Functional Diagram for Partial Off Occupant Sensor

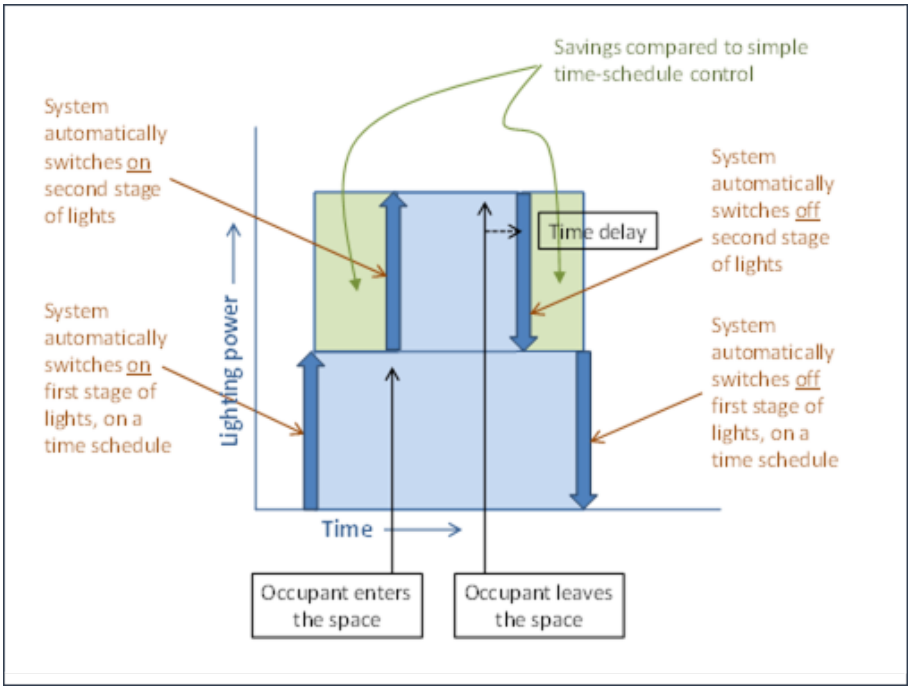


Image Source: California Energy Commission

«»

D. **Daylight Responsive Controls.**

Daylight responsive controls shall be installed in the following locations, as applicable:

i. In any enclosed space where the total installed wattage of general lighting luminaires completely or partially within skylit daylit zones is 75 watts or greater, the general lighting in the skylit daylit zones shall be controlled by daylight responsive controls.

ii. In any enclosed space where the total installed wattage of general lighting luminaires completely or partially within primary sidelit daylit zones is 75 watts or greater, the general lighting in the primary sidelit daylit zones shall be controlled by daylight responsive controls. In any enclosed space where the total wattage of general lighting luminaires in the secondary zones is 75 watts or greater, the general lighting in the secondary sidelit daylit zones shall be controlled by daylight responsive controls. General lighting in the secondary sidelit daylit zones shall be controlled independently of general lighting in the primary sidelit daylit zones. For skylights located in an atrium, the skylit daylit zones shall apply to the floor area directly under the atrium and the top floor area directly adjacent to the atrium. Parking garage areas where the total installed wattage of the general lighting in the primary and the secondary sidelit daylit zones is 60 watts or greater, the general lighting in the primary and secondary sidelit daylit zones shall be controlled by daylight responsive controls.

All daylight responsive controls shall meet the following requirements:

iii. All skylit daylit zones, primary sidelit daylit zones, secondary sidelit daylit zones and the combined primary and secondary sidelit daylit zones in parking garages shall be shown on the plans; and

Note: Parking areas on the roof of a parking structure are outdoor hardscape, not skylit daylit areas.

iv. The daylight responsive controls shall provide separate control for general lighting in each type of daylit zone. The daylight responsive controls shall meet the following:

. General lighting in overlapping skylit daylit zone and sidelit daylit zone shall be controlled as part of the skylit daylit zone.

a. General lighting in overlapping primary and secondary sidelit daylit zone shall be controlled as part of the primary sidelit daylit zone.

b. General lighting luminaires longer than 8 feet shall be controlled as segments of 8 feet or less according to the type of the daylit zone the segment is primarily located; and

Exception to Section 160.5(b)4Dviic: Where a luminaire contains a factory assembled housing and light source as an integral unit in segments longer than 8 feet, the luminaire is allowed to be controlled according to the type of the daylit zone in which the segment is primarily located.

v. The daylight responsive controls shall meet the following:

   a. For spaces where the installation of multilevel lighting controls is required under Section 160.5(b)4B, allow the multilevel lighting controls to adjust the light level with continuous dimming;

   b. For each space, ensure the combined illuminance from the controlled lighting and daylight is not less than the illuminance from controlled lighting when no daylight is available;

   c. For areas other than parking garages, ensure that when the daylight illuminance is greater than 150 percent of the illuminance provided by the controlled lighting system when no daylight is available, the controlled lighting power in that daylight zone shall be reduced by a minimum of 90 percent; and

   d. For parking garages, ensure that when daylight illuminance levels measured at the farthest edge of the secondary sidelit zone away from the glazing or opening are greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power in the combined primary and secondary sidelit daylight zones shall be reduced by 100 percent; and

vi. Photosensor shall be located so that they are not readily accessible to unauthorized personnel; and

vii. The location where calibration adjustments are made to the daylight responsive controls shall be readily accessible to authorized personnel but may be inside a locked case or under a cover that requires a tool for access; and

viii. Interaction with other lighting controls in a space where manual controls are required, the manual controls shall be capable of turning off or decreasing light levels below the light level set by the daylight responsive controls.

Exception 1 to Section 160.5(b)4D: Areas under skylights where it is documented that existing adjacent structures or natural objects block direct sunlight for more than 1,500 daytime hours per year between 8 a.m. and 4 p.m.

Exception 2 to Section 160.5(b)4D: Areas adjacent to vertical glazing below an overhang, where the overhang covers the entire width of the vertical glazing, no vertical glazing is above the overhang, and the ratio of the overhang projection to the overhang rise is greater than 1.5 for south, east and west orientations or greater than 1 for north orientations.

Exception 3 to Section 160.5(b)4D: Where daylight responsive controls are not required for the primary sidelit daylit zones, and where the total wattage of general lighting luminaires in the secondary sidelit daylit zones is less than 85 watts, daylight responsive controls are not required for the secondary sidelit zone.

Exception 4 to Section 160.5(b)4D: Reserved.

Exception 5 to Section 160.5(b)4D: Rooms that have a total glazing area of less than 24 square feet, or parking garage areas with a combined total of less than 36 square feet of glazing or opening.

Exception 6 to Section 160.5(b)4D: For parking garages, luminaires located in the daylight adaptation zone.

Exception 7 to Section 160.5(b)4D: Luminaires in sidelit daylit zones in retail merchandise sales and wholesale showroom areas.

«» Commentary for Section 160.5(b)4D:

Daylit zone is the floor area under skylights or next to windows. Types of daylit zones include primary sidelit daylit zone, secondary sidelit daylit zone, and skylit daylit zone.

Window Head Height is the vertical distance from the finished floor level to the top of a window or vertical fenestration.

There are three types of daylit zones, skylit daylit zone, primary sidelit daylit zone, and secondary sidelit daylit zone.

Skylit Daylit Zone

Skylit daylit zone is the rough area in plan view under each skylight, *plus* 0.7 times the average ceiling height in each direction from the edge of the rough opening of the skylight, *minus* any area on a plan beyond a permanent obstruction that is taller than one-half the distance from the floor to the bottom of the skylight.

Note: Modular furniture walls should not be considered a permanent obstruction.

The bottom of the skylight is measured from the bottom of the skylight well (for skylights having wells), or the bottom of the skylight if no skylight well exists.

For determining the skylit daylit zone, the geometric shape of the skylit daylit zone shall be identical to the plan view geometric shape of the rough opening of the skylight; for example, the skylit daylit zone for a rectangular skylight must be rectangular. For a circular skylight, the skylit daylit zone must be circular.

Figure 6-15: Example of Skylit Daylit Zone Layout in Overhead View

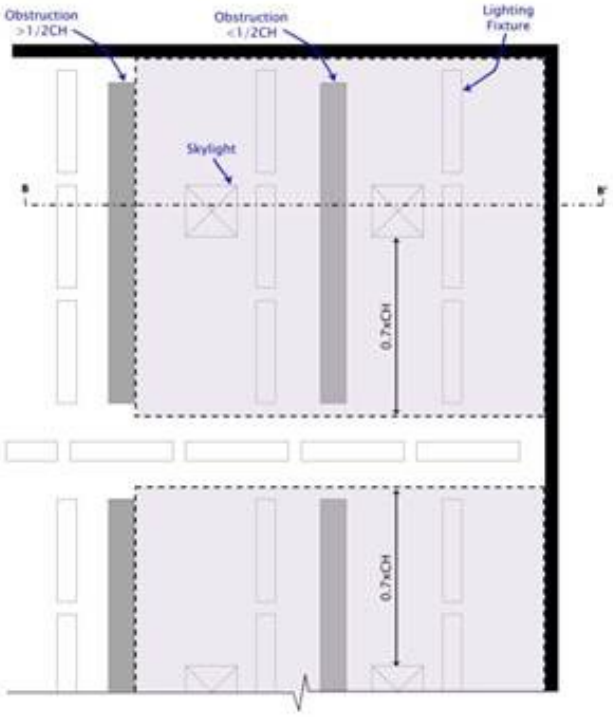


Image Source: California Energy Commission

Figure 6-16: Example of Skylit Daylit Zone Layout in Side View

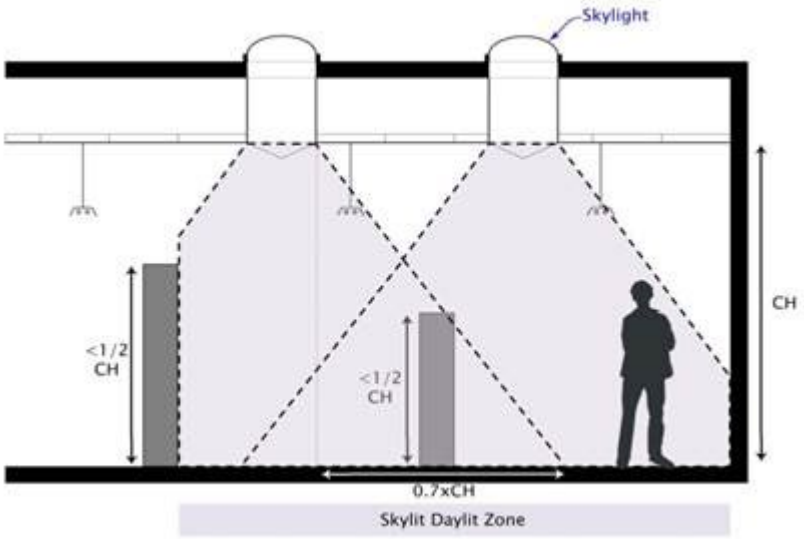


Image Source: California Energy Commission

PRIMARY SIDELIT DAYLIT ZONE

Primary sidelit daylit zone is the area in plan view directly adjacent to each vertical glazing, one window head height deep into the area, and window width *plus* 0.5 times window head height wide on each side of the rough opening of the window, *minus* any area on a plan beyond a permanent obstruction that is 6 feet or taller as measured from the floor.

Note: Modular furniture walls should not be considered a permanent obstruction.

Figure 6-17: Example of Primary Sidelit Daylit Zone Layout in Overhead View

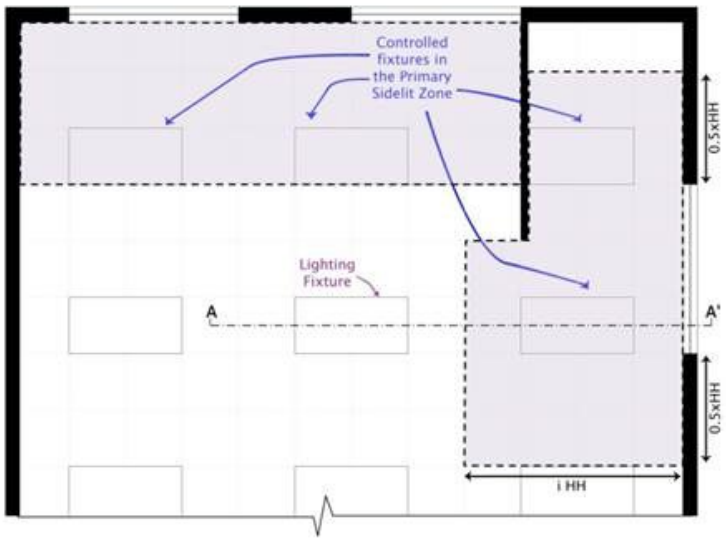


Image Source: California Energy Commission

Figure 6-18: Example of Primary Sidelit Daylit Zone Layout in Side View

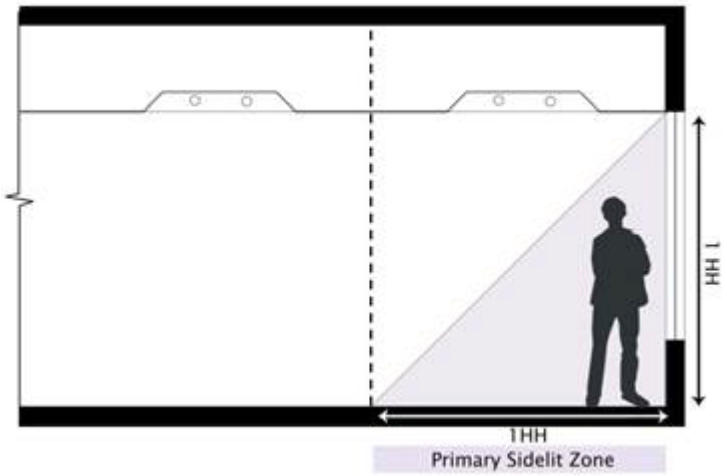


Image Source: California Energy Commission

SECONDARY SIDELIT DAYLIT ZONE

Secondary sidelit daylit zone is the area in plan view directly adjacent to each vertical glazing, two window head heights deep into the area, and window width *plus* 0.5 times window head height wide on each side of the rough opening of the window, *minus* any area on a plan beyond a permanent obstruction that is 6 feet or taller as measured from the floor.

Note: Modular furniture walls should not be considered a permanent obstruction.

Figure 6-19: Example of Secondary Sidelit Daylit Zone in Side View

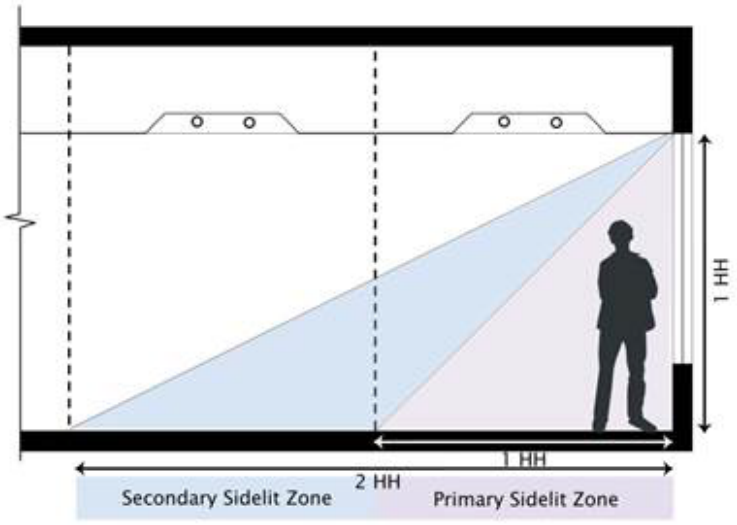


Image Source: California Energy Commission

Figure 6-20: Example of Secondary Sidelit Daylit Zone in Overhead View

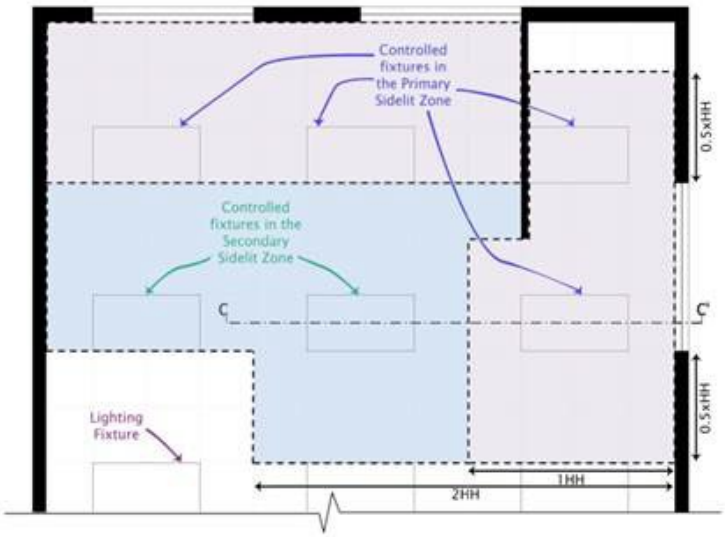


Image Source: California Energy Commission

Figure 6-21: Sidelit Daylit Zone Layout for a Bay Window

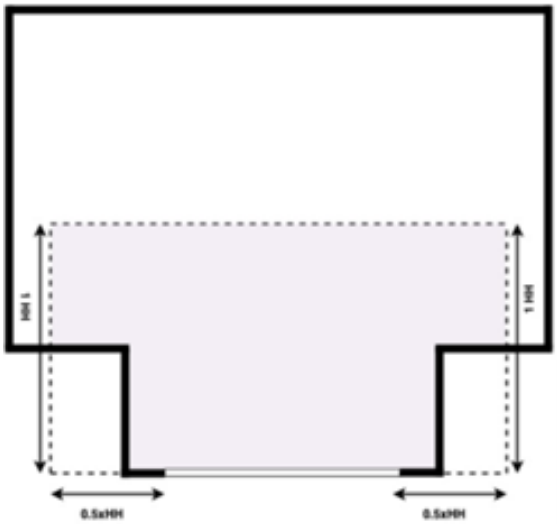


Image Source: California Energy Commission

«»

E. **Demand Responsive Controls.** See Section 110.12 for requirements for demand responsive lighting controls.

F. **Occupancy Sensing Controls interactions with Space-conditioning Systems.** For space-conditioning system zones serving only spaces that are required to have occupancy sensing controls as specified in Sections 160.5(b)4Cv and vi, 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 permitted to be controlled by occupancy sensing controls as specified in Section 120.2(e)3.

(c) Outdoor lighting and control equipment. Multifamily buildings shall comply with the applicable requirements of Sections 160.5(c)1 through 160.5(c)2.

1. **Luminaire shielding requirements.** All outdoor luminaires of 6,200 initial luminaire lumens or greater shall comply with Backlight, Uplight, and Glare (BUG) (in accordance with ANSI/IES TM-15-20, Annex A) requirements in accordance with Title 24, Part 11, Section 5.106.8.

   Exception 1 to Section 160.5(c)1: Signs.

   Exception 2 to Section 160.5(c)1: Lighting for building facades, public monuments, public art, statues and vertical surfaces of bridges.

   Exception 3 to Section 160.5(c)1: Lighting not permitted by a health or life safety statute, ordinance or regulation to be a cutoff luminaire.

   Exception 4 to Section 160.5(c)1: Temporary outdoor lighting**.**

Exception 5 to Section 160.5(c)1: Replacement of existing pole mounted luminaires in hardscape areas meeting all of the following conditions:

A. Where the existing luminaire does not meet the luminaire BUG requirements in Section 160.5(c)1; and

B. Spacing between existing poles is greater than six times the mounting height of the existing luminaires; and

C. Where no additional poles are being added to the site; and

D. Where new wiring to the luminaires is not being installed; and

E. Provided that the connected lighting power wattage is not increased.

Exception 6 to Section 160.5(c)1: Luminaires that illuminate the public right of way, including publicly maintained or utility-maintained roadways, sidewalks and bikeways.

Exception 7 to Section 160.5(c)1: Outdoor lighting attached to a multifamily building and separately controlled from the inside of a dwelling unit.

Exception 8 to Section 160.5(c)1: Luminaires that qualify as exceptions in Sections 5.106.8 of Part 11 of Title 24 and in Section 170.2(e)6A.

«» Commentary for Section 160.5(c)1:

The 2025 Energy Code includes outdoor luminaire shielding requirements based on the luminaire's initial lumen rating. See Figure 6-22: The Three Primary Solid Angles of the Luminaire Classification System for Outdoor Luminaires below for an illustration of BUG rating zones.

The BUG ratings assume that the light emitted from the luminaire is providing useful illuminance on the task surfaces rather than scattering the light in areas where the light is not needed or intended, such as toward the sky. These BUG ratings also increase visibility because high amounts of light shining directly into observer's eyes are reduced, thus decreasing glare. Additionally, light pollution into neighboring properties is reduced. The BUG requirements vary by outdoor lighting zones which are described in Section 10-114 of Title 24, Part 1.

Luminaire manufacturers typically provide the BUG ratings for their luminaires in product specifications or cutsheets. In the rare occasions where the luminaire manufacturer does not provide a BUG rating, it can be calculated with outdoor lighting software if the luminaire photometric data is available.

There are exceptions to the luminaire shielding and the BUG rating requirements in the Energy Code.

In addition, a local ordinance may have more stringent outdoor lighting BUG requirements than the CALGreen Code — the local ordinance would govern the outdoor lighting BUG requirements in that scenario.

Figure 6-22: The Three Primary Solid Angles of the Luminaire Classification System for Outdoor Luminaires

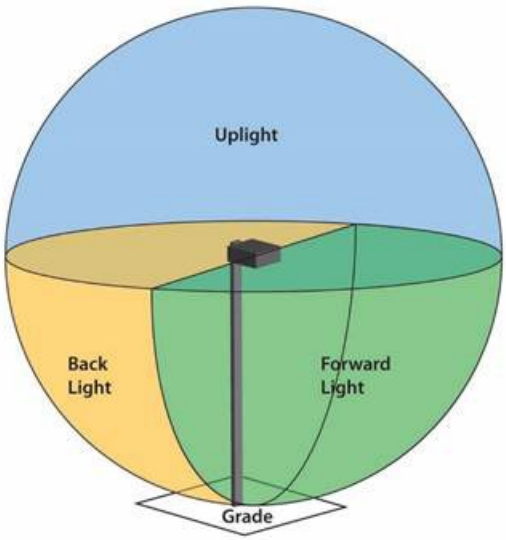


Image Source: Illuminating Engineering Society (image from ANSI/IES TM-15-20)

«»

2. **Controls for outdoor lighting.** Outdoor lighting shall be independently controlled from other electrical loads, and the controls for outdoor lighting shall meet the following functional requirements:

   Exception 1 to Section 160.5(c)2: Outdoor lighting not permitted by a health or life safety statute, ordinance or regulation to be turned OFF or reduced.

   Exception 2 to Section 160.5(c)2: Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

   A. **Daylight availability.** All installed outdoor lighting shall be controlled by a photo control, astronomical time-switch control or other control capable of automatically shutting OFF the outdoor lighting when daylight is available.

«» Commentary for Section 160.5(c)2A:

All installed outdoor lighting that is not controlled from within a dwelling unit must be controlled by a photocontrol, astronomical time-switch control, or other controls that automatically turn off the outdoor lighting when daylight is available.

1. A photocontrol measures the amount of ambient light outdoors. When the light level outside is high enough to indicate that it is daytime, the control turns lighting off.
2. Astronomical time-switch controls require an initial setup of the time clock device, which may include the entry of the current date, time, time zone, site location by longitude and latitude, and whether daylight saving time is applicable. The clock

calculates sunrise and sunset times, which vary by location and day of the year, and turns lighting off at sunrise and on at sunset.

Astronomical time switches are time-based controls that can be used to meet the daylight availability and automatic scheduling control requirements. **«»**

B. **Automatic scheduling controls.**

i. Automatic scheduling controls shall be installed for all outdoor lighting. Automatic scheduling controls may be installed in combination with motion sensing controls or other outdoor lighting controls.

ii. Automatic scheduling controls shall be capable of reducing the outdoor lighting power by 50 to 90 percent, and separately capable of turning the lighting OFF, during scheduled unoccupied periods.

iii. Automatic scheduling controls shall allow scheduling of a minimum of two nighttime periods with independent lighting levels, and may include an override function that turns lighting ON during its scheduled dim or OFF state for no more than two hours when an override is initiated.

«» Commentary for Section 160.5(c)2B:

All installed outdoor lighting that is not controlled from within a dwelling unit shall be controlled by an automatic scheduling control capable of reducing lighting power by 50 to 90 percent and separately capable of turning lighting off when not needed according to a schedule.

Further, automatic scheduling controls are required to have the capability of programming at least two nighttime periods (a scheduled occupied period and a scheduled unoccupied period) with different light levels, if desirable by the building design and operation.

Automatic scheduling controls provide flexibility to accommodate changes in building operation. If different operating schedules or different lighting levels are desired, the settings of the automatic scheduling controls can be adjusted. **«»**

C. **Motion sensing controls**.

i. Motion sensing controls shall be installed for outdoor luminaires providing lighting for general hardscape, parking lots, and outdoor canopies, where the bottom of the luminaire is mounted 24 feet above grade or lower.

ii. Motion sensing controls shall be capable of reducing the outdoor lighting power of each controlled luminaire by 50 to 90 percent, and separately capable of turning the luminaire OFF, during unoccupied periods.

iii. 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,

and of returning the lighting to its ON state when the area becomes occupied.

iv. No more than 1,500 watts of lighting power shall be controlled by a single sensor or as a single zone.

Exception 1 to Section 160.5(c)2C: Luminaires with a maximum rated wattage of 40 watts each are not required to have motion sensing controls.

Exception 2 to Section 160.5(c)2C: Applications listed as exceptions to Section 170.2(e)2A and luminaires providing lighting for building façade, ornamental hardscape or outdoor dining are not required to have motion sensing controls.

Exception 3 to Section 160.5(c)2C: Lighting subject to a health or life safety statute, ordinance or regulation may have a minimum time-out period longer than 15 minutes or a minimum dimming level above 50 percent when necessary to comply with the applicable law.

«» Commentary for Section 160.5(c)2C:

Some applications require the installation of motion-sensing controls. For these applications, automatic scheduling controls are required in addition to motion-sensing controls. During the scheduled occupied period, motion-sensing controls can detect occupancy of an outdoor space and turn on or reduce lighting based on the occupancy of the space. During the scheduled unoccupied period, the automatic scheduling control can turn off all lighting when no occupancy is detected.

The requirements for motion sensing is limited to luminaire mounting heights below 24 feet for two reasons. First, motion sensors may not be capable of reliably detecting motion in the necessary coverage area from heights of more than 24 feet. Second, as the luminaire mounting height increases, the area of coverage for a single luminaire becomes very large, which may result in undesirable or non-uniform lighting conditions that are not suitably matched for the activity. **«»**

(d) Sign lighting controls. All sign lighting shall meet the requirements below as applicable:

1. **Indoor signs.** All indoor sign lighting other than exit sign lighting shall be controlled with an automatic time-switch control or astronomical time-switch control.
2. **Outdoor signs.** Outdoor sign lighting shall meet the following requirements as applicable:
   A. All outdoor sign lighting shall be controlled with a photocontrol in addition to an automatic time-switch control, or an astronomical time-switch control.

Exception to Section 160.5(d)2A: Outdoor signs in tunnels, and signs in large permanently covered outdoor areas that are intended to be continuously lit, 24 hours per day and 365 days per year.

B. All outdoor sign lighting that is ON both day and night shall be controlled with a dimmer that provides the ability to automatically reduce sign lighting power by a minimum of 65 percent during nighttime hours. Signs that are illuminated at night and for more than 1 hour during daylight hours shall be considered ON both day and night.

Exception to Section 160.5(d)2B: Outdoor signs in tunnels and large covered areas that are intended to be illuminated both day and night.

3. **Demand Responsive Electronic Message Center (EMC) control.** See Section 110.12 for requirements for demand responsive EMC controls.

(e) Lighting control acceptance and installation certificate requirement. Multifamily common use areas shall comply with the applicable requirements of Sections 160.5(e)1 through 160.5(e)3.

1. **Lighting control acceptance requirements.** Before an occupancy permit is granted, indoor and outdoor lighting controls serving the building, area or site and installed to comply with Section 160.5(b)4D, 160.5(b)4C, 160.5(b)4E, 160.5(c)2 or 170.2(e)1Aiij shall be certified as meeting the Acceptance Requirements for Code Compliance as specified by Reference Nonresidential Appendix NA7.6 and NA7.8. A Certificate of Acceptance shall be submitted to the enforcement agency under Section 10-103(a) of Part 1 that the equipment and systems meet the acceptance requirements:

A. Reserved;

B. Reserved;

C. Daylight responsive controls shall be tested in accordance with Reference Nonresidential Appendix NA7.6.1;

«» Commentary for Section 160.5(e)1C:

Automatic daylighting controls in multifamily common areas must be tested according to NA7.6.1 to verify that they are properly installed and that they automatically adjust electric lighting power in response to available daylighting in the space. **«»**

D. Lighting shut-OFF controls shall be tested in accordance with Reference Nonresidential Appendix NA7.6.2;

«» Commentary for Section 160.5(e)1D:

Automatic shutoff controls must be tested according to NA7.6.2 to verify that occupant sensing controls and automatic time switch controls are functioning properly to achieve the desired lighting controls.

Occupant sensing control acceptance testing verifies that the controls are installed per manufacturer's instructions and that the occupant sensing control dims or turns lighting on or off according to occupancy in the space.

The automatic time switch controls acceptance testing verifies that indoor lighting controlled by an automatic time switch control turns lighting on and off according to a programmed schedule and that manual override controls turn lighting on during scheduled off periods. «»

E. Demand responsive lighting controls shall be tested in accordance with Reference Nonresidential Appendix NA7.6.3; and

«» Commentary for Section 160.5(e)1E:

Demand responsive lighting controls in multifamily common areas must be tested according to NA7.6.3 to verify that they can reduce lighting power of the building to at least 85 percent of full power. The test confirms that the lighting system produces a uniform level of illumination during a demand response event. «»

F. Outdoor lighting controls shall be tested in accordance with Reference Nonresidential Appendix NA7.8; and

«» Commentary for Section 160.5(e)1F:

This test applies to outdoor lighting controls which include photocontrols, motion sensors, astronomical time-switch controls, and scheduling controls for outdoor lighting systems per the requirements of Section 160.5(c). These controls are required for outdoor lighting in multifamily buildings, other than outdoor lighting controlled from inside a dwelling unit.

Outdoor lighting controls must be tested according to NA7.8 to verify that all outdoor lighting regulated by Section 160.5(c) is controlled by a motion sensor, photocontrol, astronomical time-switch control, and automatic scheduling control, as required. «»

G. Lighting systems receiving the Institutional Tuning Power Adjustment Factor shall be tested in accordance with Reference Nonresidential Appendix NA7.6.4.

«» Commentary for Section 160.5(e)1G:

Institutional tuning is the process of adjusting the maximum light output of lighting systems to support visual needs or save energy. Institutional tuning differs from personal tuning in that the control strategy is implemented by the building operator rather than the individual user level, and maximum light level adjustments are available only to authorized personnel.

Institutional tuning in multifamily common areas must be tested according to NA7.6.4 to verify that the institutional tuning controls limit the maximum light output or power draw of the controlled lighting to 85 percent or less of full light output or full power draw. This 85% requirement only applies if the building is using the institutional tuning

PAF to gain additional lighting watts. If not, the lighting system should be tested to confirm the institutional tuning is working as intended by the designer or engineer. **«»**

H. Demand responsive controls required to control controlled receptacles shall be tested in accordance with Reference Nonresidential Appendix NA7.6.5.

«» Commentary for Section 160.5(e)1H:

Demand responsive controls for controlled receptacles in multifamily common areas must be tested according to NA7.6.5 to verify that demand responsive controls can turn off all loads connected to controlled receptacles when a demand response signal is received. **«»**

2. **Lighting control installation certificate requirements.** To be recognized for compliance with Part 6, an Installation Certificate shall be submitted in accordance with Section 10-103(a) for any lighting control system, energy management control system, interlocked lighting system, lighting power adjustment factor, or additional wattage available for a videoconference studio, in accordance with the following requirements, as applicable:

   A. Certification that when a lighting control system is installed to comply with lighting control requirements in Part 6, it complies with the applicable requirements of Section 110.9 and complies with Reference Nonresidential Appendix NA7.7.1.

   B. Certification that when an energy management control system is installed to function as a lighting control required by Part 6, it functionally meets all applicable requirements for each application for which it is installed, in accordance with Sections 110.9, 160, 170 and 180, and complies with Reference Nonresidential Appendix NA7.7.2.

   C. Certification that interlocked lighting systems used to serve an approved area comply with Section 170.2(e)2A and comply with Reference Nonresidential Appendix NA7.7.4.

   D. Certification that lighting controls installed to earn a lighting Power Adjustment Factor (PAF) comply with Section 170.2(e)2B and comply with Reference Nonresidential Appendix NA7.7.5.

   E. Reserved.

«» Commentary for Section 160.5(e)2D:

The certificate of installation is used primarily as a declaration that the installed lighting and controls matches what is claimed on the certificate of compliance. The certificate of installation is signed by the licensed person that completed the installation.

The required multifamily common use area indoor lighting certificates of installation include the following:

1. For multifamily buildings four habitable stories or more: NRCI-LTI-E — must be submitted for all buildings. This is the general certificate of installation used to declare that what was proposed in the certificates of compliance is what was installed.
2. For multifamily buildings up to three habitable stories: LMCI-LTI-E — must be submitted for all buildings. This is the general certificate of installation used to declare that what was proposed in the certificates of compliance is what was installed. **«»**
3. When certification is required by Title 24, Part 1, Section 10-103.1, the acceptance testing specified by Section 160.5(e) shall be performed by a Certified Lighting Controls Acceptance Test Technician (CLCATT). If the CLCATT is operating as an employee, the CLCATT shall be employed by a Certified Lighting Controls Acceptance Test Employer. The CLCATT shall disclose on the Certificate of Acceptance a valid CLCATT certification identification number issued by an approved Acceptance Test Technician Certification Provider. The CLCATT shall complete all Certificate of Acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

«» Commentary for Section 160.5(e)3:

Acceptance requirements ensure that equipment, controls, and systems operate as required by the Energy Code. Acceptance testing consists of:

1. Visual inspection of the equipment and installation.
2. Functional testing of the systems and controls.

Individual acceptance tests may be performed by one or more field technicians under the responsible charge of a licensed contractor or design professional, (responsible person) eligible under Division 3 of the Business and Professions Code, in the applicable classification, to accept responsibility for the scope of work specified by the certificate of acceptance document. The responsible person must review the information on the certificate of acceptance form and sign the form to certify compliance with the acceptance requirements:

Typically, the individuals who perform the field testing/verification work and provide the information required for completion of the acceptance form (field technicians) are contractors, engineers, or commissioning agents. Field technicians do not need to be a third-party and are not required to be licensed contractors or licensed design professionals. Only the responsible person who signs the certificate of acceptance form certifying compliance must be licensed.

When certification is required by Title 24, Part 1, Section 10-103.1, acceptance testing must be performed by a certified lighting controls acceptance test technician. Acceptance test technicians receive hands-on and classroom training on the testing procedures and must pass an exam to become certified. Acceptance test technicians are

trained and certified by an Energy Commission approved Acceptance Test Technician Certification Provider. **«»**

SECTION 160.6 – MANDATORY REQUIREMENTS FOR ELECTRICAL POWER DISTRIBUTION SYSTEMS

Multifamily buildings shall comply with the applicable requirements of Sections 160.6(a) through 160.6(e).

(a) Service electrical metering. Each electrical service or feeder that provides power to the common use areas (interior and exterior) shall have a permanently installed metering system that measures electrical energy use in accordance with Table 160.6-A.

Exception to **Section 160.6(a)**: Service or feeder for which the utility company provides a metering system for the multifamily building that indicates instantaneous kW demand and kWh for a utility-defined period.

TABLE 160.6-A MINIMUM REQUIREMENTS FOR METERING OR SUBMETERING OF ELECTRICAL LOAD

Metering Functionality	Electrical Services[1] rated 50 kVA or less	Electrical Services[1] rated more than 50kVA and less than or equal to 250 kVA	Electrical Services[1] rated more than 250 kVA and less than or equal to 1000kVA	Electrical Services[1] rated more than 1000kVA
Instantaneous (at the time) kW demand	Required	Required	Required	Required
Historical peak demand (kW)	Not required	Not required	Required	Required
Tracking kWh for a user-definable period.	Required	Required	Required	Required
kWh per rate period	Not required	Not required	Not required	Required

1 "Electrical Services" applies to the building service-entrance rating or to the submetering service. For a building with submetering, this applies to the submetering service size to the common use areas.

«» Commentary for Section 160.6(a):

This is not a requirement to install meters at the service and at each feeder. Rather, this requirement simply prevents unmetered service or feeder circuits from being installed within a building by requiring that a meter be installed at either the service level or, if not at the service level, at the feeder level. **«»**

(b) Separation of electrical circuits for electrical energy monitoring. Electrical power distribution systems shall be designed so that measurement devices can monitor the electrical energy usage of load types according to Table 160.6-B.

Exception 1 to Section 160.6(b): For each separate load type, up to 10 percent of the connected load may be of any type.

Exception 2 to Section 160.6(b): Submetered electrical power distribution systems that provide power to dwelling units.

TABLE 160.6-B MINIMUM REQUIREMENTS FOR SEPARATION OF ELECTRICAL LOAD

Electrical Load Type	**Electrical Services1 rated 50 kVA or less**	**Electrical Services1 rated more than 50kVA and less than or equal to 250 kVA**	**Electrical Services1 rated more than 250 kVA and less than or equal to 1000kVA**	**Electrical Services1 rated more than 1000kVA**
Lighting including exit and egress lighting and exterior lighting	Not required	All lighting in aggregate	All lighting disaggregated by floor, type or area	All lighting disaggregated by floor, type or area
HVAC systems and components including chillers, fans, heaters, furnaces, package units, cooling towers, and circulation pumps associated with HVAC	Not required	All HVAC in aggregate	All HVAC in aggregate and each HVAC load rated at least 50 kVA	All HVAC in aggregate and each HVAC load rated at least 50kVA
Domestic and service water system pumps and related systems and components	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate

Plug load including appliances rated less than 25 kVA	Not required	All plug load in aggregate Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf	All plug load separated by floor, type or area Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf	All plug load separated by floor, type or area All groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf
Elevators, escalators, moving walks, and transit systems	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Renewable power source (net or total)	Each group	Each group	Each group	Each group
Loads associated with renewable power source	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Charging stations for electric vehicles	All loads in aggregate	All loads in aggregate	All loads in aggregate	All loads in aggregate

1 "Electrical Services" applies to the building service-entrance rating or to the submetering service. For a building with submetering, this applies to the submetering service size to the common use area.

«» Commentary for Section 160.6(b):

The separation of electrical circuits requirement allows monitoring the specific contributions of separate loads to the overall energy use of a building. By designing the electrical distribution system with separation of electrical loads in mind, energy monitoring can be readily set up and implemented without significant physical changes to the electrical installations.

The goal of this requirement is to be able to monitor the electrical energy usage of each load type specified in Table 160.6-B of the Energy Code. Building owners, facility management, and others can make use of such energy usage information to better understand how much energy has been used by each building system during a certain period. Further analysis of such energy information can help facilitate energy efficiency and related measures to improve building energy performance for building owners and operators.

The Energy Code allows the use of conventional panelboards, motor control centers, and other standard wiring methods for meeting the separation requirement. The requirement may also be met by a well-planned wiring approach, such as connecting all HVAC units to a single feeder from the service using a combination of through feeds and

taps. The regulations are intentionally written to specify the "what" without prescribing the "how," providing flexibility.

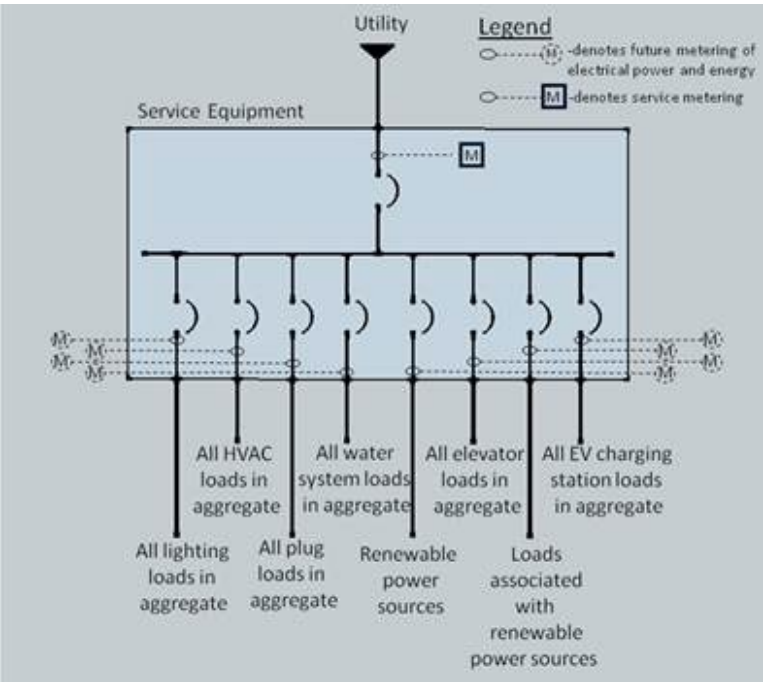
The separation of electrical circuits requirement may be satisfied by any method that accomplishes this goal, including any of the following example methods:

Example Method 1

Switchboards, motor control centers, or panelboards may be separated by load type, allowing energy measurement of each load type independently and readily. This method must allow measurement and determination of the actual interval demand load value for each disaggregated load in the system.

This is a straightforward approach for measurement of each load type, as each switchboard, motor control center, or panelboard serves a single load type. Summation of the load measurement of the distribution equipment in accordance with the respective load type can result in the energy usage of each load type. This method is simple and straightforward in terms of the effort required in compiling the measurement data.

Figure 6-23: Separation of Electrical Circuits by Panelboard



Source: California Energy Commission

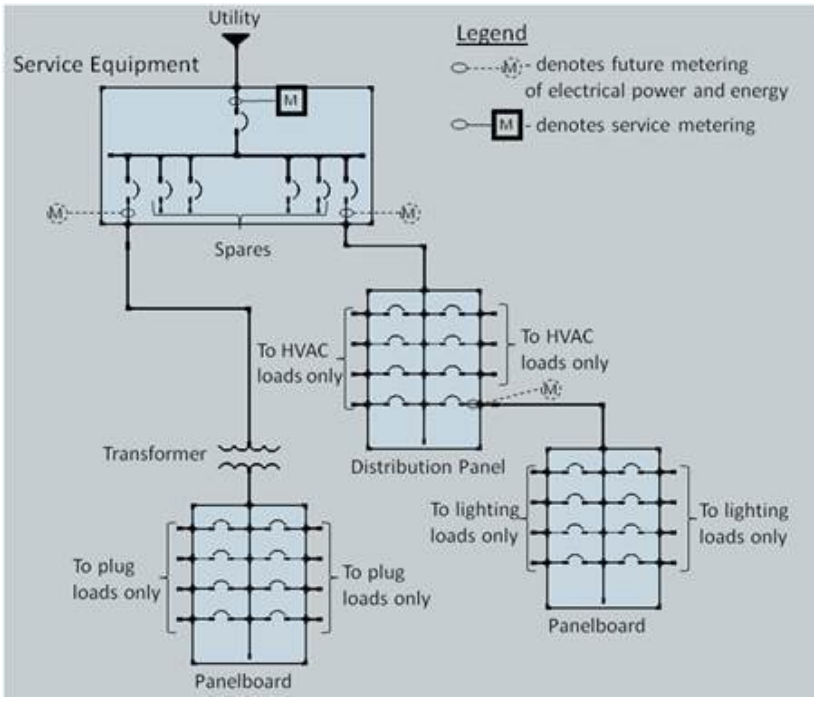
Example Method 2

Switchboards, motor control centers, or panelboards may supply other distribution equipment with the associated loads separated for each load type. The measured load for each piece of distribution equipment must be able to be added or subtracted from

other distribution equipment supplying them. This method must allow measurement for each disaggregated load in the system.

This method allows distribution equipment to serve more than one load type while allowing the separate energy use of each load to be determined. More effort may be required in obtaining the energy usage of each load type.

Figure 6-24: Separation of Electrical Circuits by Panelboards and Subpanels

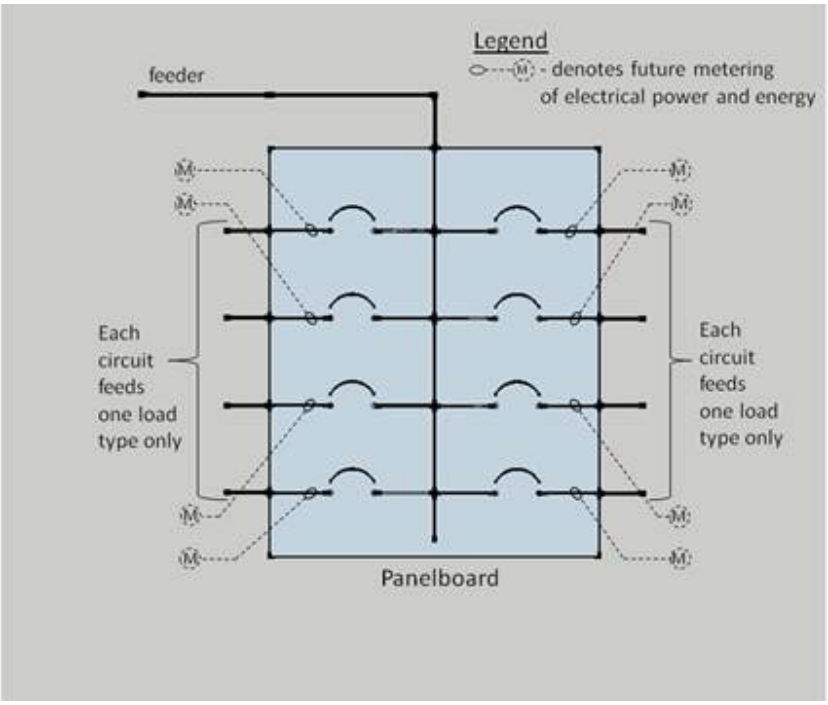


Source: California Energy Commission

Example Method 3

Switchboards, motor control centers, or panelboards may supply more than one load type as long as each branch circuit serves a single load type, and the equipment includes provisions for measuring individual branch circuits. For example, neighboring branch circuits in a panelboard may serve receptacles and fans, respectively, but the branch circuits cannot serve mixed load types.

Figure 6-25: Separation of Electrical Circuits by Branch Circuits



Source: California Energy Commission

Example Method 4

Buildings for which a complete metering and measurement system is provided so each load type can be measured separately. Such an installation goes beyond the requirement of the Energy Code as it meters and measures the power and energy usage of each load type. It provides benefits for building owners and operators by giving them a readily available tool for assessing the building energy usage as soon as the facility is turned over to them. **«»**

(c) Voltage drop. The maximum combined voltage drop on both installed feeder conductors and branch circuit conductors to the farthest connected load or outlet shall not exceed 5 percent.

Exception to Section 160.6(c): Voltage drop permitted by California Electrical Code Sections 647.4, 695.6 and 695.7.

«» Commentary for Section 160.6(c):

The maximum combined voltage drop on both installed feeder conductors and branch circuit conductors to the farthest connected load or outlet must not exceed 5 percent. This is the steady-state voltage drop under normal load conditions.

The voltage drop permitted by California Electrical Code Sections 647.4, 695.6, and 695.7 are exempted from this requirement.

Voltage drop losses are cumulative, so voltage drop in feeders and voltage drop in branch circuits contribute to the load at the end of the branch circuit. Excessive voltage drop in the feeder conductors and branch circuit conductors can result in inefficient operation of electrical equipment and shortened equipment life expectancy. **«»**

(d) Circuit controls for 120-volt receptacles and controlled receptacles. In all common areas, both controlled and uncontrolled 120 volt receptacles shall be provided in office areas, lobbies, conference rooms, kitchen areas in office spaces, and copy rooms. Plug-in strips and other plug-in devices shall not be used to comply with the requirements of this section.

Controlled receptacles shall meet the following requirements, as applicable:

1. Install a control capable of automatically shutting OFF the controlled receptacles when the space is typically unoccupied, either at the receptacle or circuit level. When an automatic time switch control is installed it shall incorporate an override control that allows the controlled receptacle to remain ON for no more than 2 hours when an override is initiated and an automatic holiday "shut-OFF" feature that turns OFF all loads for at least 24 hours and then resumes the normally scheduled operation. Countdown timer switches shall not be used to comply with the automatic time switch control requirements; and
2. Install at least one controlled receptacle within 6 feet from each uncontrolled receptacle, or install a multiple receptacle outlet with at least one controlled and one uncontrolled receptacle. Where receptacles are installed in modular furniture in open office areas, at least one controlled receptacle shall be installed at each workstation; and
3. Provide a permanent marking for controlled receptacles or circuits to differentiate them from uncontrolled receptacles or circuits; and

Exception 1 to Section 160.6(d): Receptacles that are only for the following purposes:

A. Receptacles specifically for refrigerators and water dispensers in kitchen areas.

B. Receptacles located a minimum of six feet above the floor that are specifically for clocks.

C. Receptacles for network copiers, fax machines, A/V and data equipment other than personal computers in copy rooms.

D. Receptacles on circuits rated more than 20 amperes.

E. Receptacles connected to an uninterruptible power supply (UPS) that are intended to be in continuous use, 24 hours per day/365 days per year, and are marked to differentiate them from other uncontrolled receptacles or circuits.

Exception 2 to Section 160.6(d): Receptacles in common use areas providing shared provisions for living, eating, cooking or sanitation to dwelling units that would otherwise lack these provisions.

«» Commentary for Section 160.6(d):

In multifamily common use areas, the Energy Code requires controlled and uncontrolled 120-volt receptacles. Controlled receptacles allow plug loads to be turned off automatically when the space is unoccupied, resulting in energy savings.

The following are example approaches to meeting the controlled receptacle requirement.

Private Offices, Conference Rooms, and Other Spaces With Periodic Occupancy

Occupant-sensing controls that are part of a lighting control system may be used to control general lighting and receptacles. For example, a common occupancy sensor can control general lighting and receptacles, with auxiliary relays connected to the lights and the controlled receptacles to provide the needed functionality.

Lobbies, Break Rooms, and Other Spaces With Frequent Occupancy During Business Hours

Astronomical time-switch controls, with either a vacancy sensor or switch override, can be used to control receptacles. Programmable relay panels or controllable breakers can be used, or, for simpler projects, a combination of vacancy sensors and programmable time switches can accomplish the same task. If vacancy sensing is used, controls will likely need to be room-by-room or space-by-space, but if time-switch control with manual override is used, whole circuits may be controlled together.

Open Office Areas

Receptacles in open office areas can be controlled by the automatic shutoff system of the building or by controls integrated into the modular furniture systems. Automatic time-switch controls with relays or controllable breakers, and manual override switches, may be used for zones within an open office space. A system using vacancy sensors might also be considered if sensors can be added as needed to address partitioning of the workstations (thus ensuring proper operation). Systems contained within workstation systems are an acceptable alternative provided that they are hardwired as part of the workstation wiring system.

Networked Control Systems and Building Automation Systems

Most advanced lighting and energy control systems can be easily designed to accommodate receptacle controls.

Certain office appliances, such as computers, need to be powered continuously during normal operating hours to provide uninterrupted service. These would be connected to uncontrolled receptacles. Other appliances, such as task lamps, fans, heaters, and monitors, do not need to be powered when occupants are not present. These controllable loads would be plugged into the controlled receptacles to ensure they are automatically shut off and to prevent any unnecessary standby power draw.

In open office areas, it is advisable to implement vacancy sensor controls at each workstation or cubicle to maximize the opportunities of shutoff controls. Modular office system furniture is usually equipped with more than one internal electrical circuit, and some of these circuits can be dedicated for controllable plug loads. **«»**

(e) Demand responsive controls and equipment**.** See Section 110.12 for requirements for demand responsive controls and equipment, including demand responsive controls for controlled receptacles.

NOTE: Definitions of terms and phrases in Section 160.6 are determined as specified in Section 100.1(b). Terms and phrases not found in Section 100.1(b) shall be defined as specified in Title 24, Part 3, Article 100 of the California Electrical Code.

SECTION 160.9 – MANDATORY REQUIREMENTS FOR ELECTRIC READY BUILDINGS

(a) General requirements. Multifamily buildings shall comply with the applicable requirements of subsection 160.9. The building electrical system shall be sized to meet the future electric requirements of the electric ready equipment specified in sections 160.9(b) through (f). The building main service conduit, the electrical system to the point specified in each subsection, and any on-site distribution transformers shall have sufficient capacity to supply full rated amperage at each electric ready appliance in accordance with the California Electrical Code.

«» Commentary for Section 160.9(a):

The electric ready requirements apply to gas equipment used for dwelling unit space heating, water heating, and cooking as well as dwelling unit and common area clothes dryers. Electric ready requirements minimize future retrofit costs when electric appliances replace gas appliances.

In addition to appliance-specific electric ready requirements outlined below, Section 160.9(a) requires building main service conduit, the electrical system to the point specified in each subsection, and any onsite distribution transformers to have sufficient capacity to supply full rated amperage for each electric ready appliance in accordance with California Electric Code.

Some provisions should be appropriately labelled as specified so that they can be readily identified in the future when it comes to the time that the electric appliances (such as heat pump space heaters) are installed.

Note that the electric ready requirements may involve more than one design professional or trade installers work to meet. In an example of the heat pump space heater ready requirements, it could require a mechanical engineer to select the heat pump space heater in terms of its cooling and heating capacity and could require an electrical engineer to select the branch circuiting requirement for the heat pump space heater.**«»**

(b) Heat Pump Space Heater Ready. Systems using gas or propane furnaces to serve individual dwelling units shall include the following:

1. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the furnace and accessible to the furnace with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be

identified as "240V ready." All electrical components shall be installed in accordance with the California Electrical Code.

2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future heat pump space heater installation. The reserved space shall be permanently marked as "For Future 240V use."

«» Commentary for Section 160.9(b):

This section ensures that individual dwelling unit space heating systems using gas or propane are "electric ready," facilitating a future transition to heat pump space heaters. These requirements ensure adequate electrical infrastructure to serve a future heat pump space heater installed in the same location as the existing gas or propane furnace. Receptacles are not required. Equipment serving multifamily common use areas are not subject to electric ready requirements. **«»**

(c) Electric Cooktop Ready. Systems using gas or propane cooktops to serve individual dwelling units shall include the following:

1. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the cooktop and accessible to the cooktop with no obstructions. The branch circuit conductors shall be rated at 50 amps minimum. The blank cover shall be identified as "240V ready." All electrical components shall be installed in accordance with the California Electrical Code.

2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric cooktop installation. The reserved space shall be permanently marked as "For Future 240V use."

«» Commentary for Section 160.9(c):

This section ensures that dwelling units with gas or propane cooktops are "electric ready," facilitating a future transition to an electric cooktop. These requirements ensure adequate electrical infrastructure to serve a future electric cooktop installed in the same location as the existing gas or propane cooktop. Receptacles are not required. Cooktops in multifamily common use areas are not subject to electric ready requirements. **«»**

(d) Electric Clothes Dryer Ready. Clothes dryer locations with gas or propane plumbing shall include the following:

1. Systems serving individual dwelling units shall include:

   A. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the clothes dryer location and accessible to the clothes dryer location with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be identified as "240V ready." All electrical

components shall be installed in accordance with the California Electrical Code.

B. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric clothes dryer installation. The reserved space shall be permanently marked as "For Future 240V use."

2. Systems in common use areas shall include:

A. Conductors or raceway shall be installed with termination points at the main electrical panel, via subpanels panels if applicable, to a location no more than 3 feet from each gas outlet or a designated location of future electric replacement equipment. Both ends of the conductors or raceway shall be labelled "Future 240V Use." Gas flow rates shall be determined in accordance with the California Plumbing Code. Capacity shall be one of the following:

i. 24 amps at 208/240 volts per clothes dryer;

ii. 2.6 kVA for each 10,000 Btu per hour of rated gas input or gas pipe capacity; or

iii. The electrical power required to provide equivalent functionality of the gas-powered equipment as calculated and documented by the responsible person associated with the project.

«» Commentary for Section 160.9(d):

This section ensures that gas or propane clothes dryers in multifamily dwelling units or common use areas are "electric ready," facilitating a future transition to electric clothes dryers. These requirements ensure adequate electrical infrastructure to serve a future electric clothes drying in the same location as the existing gas or propane clothes dryer(s). Receptacles are not required. **«»**

(e) Individual Heat Pump Water Heater Ready. Systems using gas or propane water heaters to serve individual dwelling units shall include the following components for each gas or propane water heater:

1. A dedicated 125 volt, 20 amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor branch circuit rated to 30 amps minimum, within 3 feet from the water heater and accessible to the water heater with no obstructions. In addition, all the following:

A. Both ends of the unused conductor shall be labeled with the word "spare" and be electrically isolated; and

B. A reserved single pole circuit breaker space in the electrical panel adjacent to the circuit breaker for the branch circuit in A above and labeled with the words "Future 240V Use"; and

2. A condensate drain that is no more than 2 inches higher than the base of the installed water heater and allows natural draining without pump assistance, and

3. The construction drawings shall designate a space at least 39 inches by 39 inches and 96 inches tall for the future location of heat pump water heater.

4. A ventilation method meeting one of the following:

A. The designated space for the future heat pump water heater shall have a minimum volume of 700 cubic feet; or

B. If the future HPWH space is designed to vent indoors, the designated space for the future heat pump water heater shall vent to a communicating space in the same pressure boundary. The total combined volume connected shall be 700 cubic feet or larger and vent to the interior via:

i. Fully louvered doors with fixed louvers consisting of a single layer of fixed flat slats and a minimum total NFA of 250 square inches; or

ii. Two permanent openings of equal area with a minimum total NFA of 250 square inches located within 12 inches from the enclosure top and bottom; or

iii Two 8-inch ducts to a communicating space.

C. If the future HPWH space is designed to vent to the building exterior, the designated space for the future heat pump water heater shall vent to the exterior via:

i. Fully louvered doors with fixed louvers consisting of a single layer of fixed flat slats and a minimum total NFA of 250 square inches; or

ii. Two permanent openings of equal area with a minimum total NFA of 250 square inches located within 12 inches from the enclosure top and bottom; or

iii. Two 8 inches capped ducts. All ducts that cross the pressure boundary shall be insulated to a minimum insulation level of R-6 and the ducts, connections, and building penetrations shall be sealed.

«» Commentary for Section 160.9(e):

This section ensures that individual water heating systems (one water heater serving one dwelling unit) using gas or propane to generate hot water for a single dwelling unit are "electric ready," facilitating a future transition to heat pump water heaters. In addition to ensuring adequate electrical infrastructure to serve a future heat pump

water heater, the code requirements also ensure adequate space, ventilation, and condensate drainage to serve a future heat pump water heater based on products that are currently on the market. Receptacles are required for dwelling unit water heating and must be connected to the panel with a 120/240V, 3-conductor of 30 amp ampacity minimum (such as 10 AWG copper wire conductor) with both ends of the unused conductor labeled as spare and be electrically isolated. «»

(f) Central Heat Pump Water Heater Ready. Central water heating systems using gas or propane to serve multiple dwelling units shall meet the following requirements:

1. The system input capacity of the gas or propane water heating system shall be determined as the sum of the input gas or propane capacity of all water heating devices associated with each gas or propane water heating system.

2. Space reserved shall include:

A. Heat Pump. The minimum space reserved shall include space for service clearances and air flow clearances and shall meet one of the following:

i. The space reserved shall be the space required for a heat pump water heater system that meets the total building hot water demand as calculated and documented by the responsible person associated with the project; or

ii. The space reserved shall meet the requirements specified in Joint Appendix JA15.2.1.

«» Commentary for Section 160.9(f):

This section ensures that central water heating systems using gas or propane for multiple dwelling units are "electric ready," facilitating a future transition to heat pump water heaters. The code language was developed to address retrofit installation challenges that are very costly or make retrofit to heat pumps infeasible, based on input from practitioners. There are two primary approaches to achieve this:

1. Design Approach: This approach allows designers to assess the specific heating load and requirements of their project, providing flexibility in planning for space reserved, ventilation, condensate drainage, and electrical infrastructure. Each building's unique characteristics can be accounted for, resulting in a more tailored and potentially smaller infrastructure setup. Furthermore, this pathway allows for more flexibility to plan for system types that do not require a swing tank.
2. Sizing Factors Approach (Joint Appendix): This method follows the sizing factors set forth in Joint Appendix JA15. This approach allows for easier implementation, but is intended to be conservative and may result in larger reserved spaces and capacities than the Design Approach. There are two sets of sizing factors for the Sizing Factors Approach. One set of sizing factors is used for gas water heaters with an input rate less than 200,000 BTU/hr and one set of sizing factors is used

for systems with higher input rates. Having two sets of sizing factors reduces the cost of compliance. «»

B. Tanks. The minimum space reserved shall include space for service clearances and shall meet one of the following:

i. The space reserved shall be the space required for a heat pump water heater system that meets the total building hot water demand as calculated and documented by the responsible person associated with the project; or

ii. The space reserved shall meet the requirements specified in Joint Appendix JA15.2.2.

3. Ventilation shall be provided by meeting one of the following:

A. Physical space reserved for the heat pump shall be located outside; or

B. A pathway shall be reserved for future routing of supply and exhaust air via ductwork from the reserved heat pump location to a suitable outdoor location. Penetrations through the building envelope for louvers and ducts shall be planned and identified for future use. The reserved pathway and penetrations through the building envelope shall be sized to meet one of the following:

i. The reserved pathway and penetrations shall be sized to serve a heat pump water heater system that meets the total building hot water demand as calculated and documented by the responsible person associated with the project.

ii. The reserved pathway and penetrations shall be sized to meet the requirements specified in Joint Appendix JA15.2.3.

«» Commentary for Section 160.9(f)3:

Heat pumps may be installed outside to simplify access to adequate air flow and clearance. However, when an indoor installation is necessary, it's critical to plan for future ductwork and building envelope penetrations. This planning ensures the heat pump can be properly ventilated, maintaining its efficiency and performance. «»

4. Condensate drainage piping. An approved receptacle that is sized per the California Plumbing Code for condensate drainage shall be installed within 3 feet of the reserved heat pump location, or piping shall be installed from within 3 feet of the reserved heat pump location to an approved discharge location that is sized in accordance with the California Plumbing Code, and meet one of the following:

i. Condensate drainage shall be sized to serve a heat pump water heater system that meets the total building hot water demand as calculated and documented by the responsible person associated with the project.

ii. Condensate drainage piping shall be sized to meet the requirements specified in Joint Appendix JA15.2.4.

«» Commentary for Section 160.9(f)4:

Air source heat pump water heaters may produce condensate on the air-source coil. Unlike the condensate generated by some gas-fired water heaters which requires acid neutralization, the condensate from a heat pump water heater is not acidic and simply requires proper drainage. The intent of the electric ready condensate drainage requirement is to ensure that a future heat pump water heater has access to a suitable drainage system to discharge condensate. **«»**

5. Electrical

A. Physical space shall be reserved on the bus system of the main switchboard or on the bus system of a distribution board to serve the future heat pump water heater system, including the heat pump and temperature maintenance tanks. In addition, the physical space reserved shall be capable of providing adequate power to the future heat pump water heater in accordance with the following:

i. Heat Pump. Meet one of the following.

A. The electrical power required to power a heat pump water heater system that meets the total building hot water demand as calculated and documented by the responsible person associated with the project.

B. The electrical power required that meets the requirements specified for the heat pump in Joint Appendix JA15.2.5.

«» Commentary for Section 160.9(f)5:

Unlike some electric readiness requirements that mandate installation of conductors and/or conduit to the future equipment location, the requirements of this section are focused on ensuring adequate physical space and capacity in the upstream electrical infrastructure. The reason for this difference is that adequately sized building level infrastructure is critical to enabling a future low cost retrofit whereas a single conduit and conductor can often be retrofitted with relative ease. Furthermore, as compared to other equipment there is a higher possibility that the location of the future heat pump water heater may change from what is originally planned. The combination of these factors is why conduit and conductors are not required for central heat pump water heater electric readiness. **«»**

ii. Temperature Maintenance Tank. Meet one of the following.

A. The electrical power required to power a heat pump water heater system temperature maintenance tank that meets the total building hot water demand as calculated and documented by the responsible person associated with the project.

B. The electrical power required that meets the requirements specified for the temperature maintenance tank in Joint Appendix JA15.2.5.

SECTION 170.1 – PERFORMANCE APPROACH

A building complies with the performance approach if the energy consumption calculated for the proposed design building is no greater than the energy budget calculated for the standard design building using Commission-certified compliance software as specified by Sections 10-109, 10-116 and the Alternative Calculation Method Reference Manual.

(a) Energy budget. The Energy budget is expressed in terms of long-term system cost (LSC) and source energy:

1. **Long-term system cost (LSC).** The LSC energy budget is determined by applying the mandatory and prescriptive requirements of the standard design to the proposed design building and has two components, the Efficiency LSC and the Total LSC.
   A. The Efficiency LSC energy is the sum of the LSC energy for space-conditioning, water heating, mechanical ventilation, lighting and the self-utilization credit.
   B. The Total LSC energy is the sum of the Efficiency LSC energy and LSC energy from the photovoltaic system, battery energy storage systems (BESS), and demand flexibility.
2. **Source energy.** The source energy budget is determined by applying the mandatory and prescriptive requirements of the standard design, except with a consumer gas or propane water heater, to the proposed design building.

Exception to Section 170.1(a): A community shared solar electric generation system, or other renewable electric generation system, and/or community shared BESS, that provides dedicated power, utility energy reduction credits or payments for energy bill reductions to the permitted building and is approved by the Energy Commission as specified in Title 24, Part 1, Section 10-115, may offset part or all of the solar electric generation system or BESS LSC energy required to comply with the standards, as calculated according to methods established by the Commission in the Nonresidential ACM Reference Manual.

(b) Compliance demonstration requirements for performance standards.

1. Certificate of Compliance and Application for a Building Permit. The application for a building permit shall include documentation pursuant to Sections 10-103(a)1 and 10-103(a)2 that demonstrates, using an approved calculation method, that the building has been designed so that its source energy and LSC energy consumption do not exceed the standard design energy budgets for the applicable climate zone.

2. Field verification of individual dwelling unit systems. When performance of installed features, materials, components, manufactured devices or systems above the minimum specified in Section 170.2 is necessary for the building to comply with Section 170.1, or is necessary to achieve a more stringent local ordinance, field verification shall be performed in accordance with the applicable requirements in the following subsections, and the results of the verification(s) shall be documented on applicable Certificates of Installation pursuant to Section 10-103(a)3 and applicable Certificates of Verification pursuant to Section 10-103(a)5.

«» Commentary for Section 170.1(a):

The performance approach is applicable when the designer uses a compliance software program approved by the Energy Commission to demonstrate that the proposed building's energy consumption (including common use area indoor lighting power) meets the energy budget.

The energy budget assumes a standard dwelling unit lighting energy use (based on mandatory dwelling unit lighting requirements), and those requirements cannot be traded off using the performance approach. The performance approach cannot be used to comply with outdoor or sign lighting requirements, those systems must comply with mandatory and prescriptive requirements.

No additional lighting power allotment is gained by using the performance method unless it is traded from the space conditioning, mechanical ventilation, service water heating, envelope, or covered process systems. **«»**

SECTION 170.2 – PRESCRIPTIVE APPROACH

(e) **Lighting.** Dwelling unit lighting shall meet the applicable mandatory requirements of Section 160.5(a). Common use area lighting shall meet the following requirements:

Exception to Section 170.2(e): Common use areas providing shared provisions for living, eating, cooking or sanitation to dwelling units that would otherwise lack these provisions may instead comply with Section 160.5(a).

«» Commentary for Section 170.2(e):

The prescriptive compliance approach for multifamily common use area lighting establishes an adjusted lighting power for a proposed design as well as a maximum lighting power that can be installed based on the space types. The process for calculating adjusted lighting power for multifamily common use area indoor lighting is closely aligned to the corresponding process for nonresidential buildings.

The differences between the prescriptive requirements for common use areas in multifamily buildings and nonresidential buildings include:

1. Only the area category method may be used per Section 170.2(e)3. Common use areas may not use the complete building method for lighting power allowance calculations.
2. The primary function area types included in the multifamily common use area lighting power density Table 170.2-M differ from the corresponding nonresidential primary function area types included in Table 140.6-C.
3. The primary function area types included in Table 170.2-M are specific to multifamily common use areas and do not include nonresidential primary function area types.
4. Common use areas providing shared provisions for living, eating, cooking, or sanitation to dwelling units that would otherwise lack these provisions may instead comply with the requirements for dwelling units per Section 160.5(a).

Lighting Terms Related to the Area Category Method

1. Accent Lighting is directional lighting to emphasize a particular object or surface feature, or to draw attention to a part of the field of view. It can be recessed, surface mounted, or mounted to a pendant, stem, or track, and can be display lighting. It shall not provide general lighting.
2. 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.

3. Dim-to-warm (also known as warm dim) light source is capable of simultaneously decreasing its correlated color temperature as its light output decreases, typically resembling the change in color temperature of an incandescent lamp as it dims.
4. Floor Display Lighting is supplementary lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance required to highlight features, such as merchandise on a clothing rack or sculpture or free standing artwork, which is not displayed against a wall.
5. General lighting (also known as ambient lighting) is electric lighting that provides a uniform level of illumination throughout an area exclusive of any provision for special visual tasks or decorative effect, or exclusive of daylighting.
    - Typical luminaires used for general lighting are troffers (prismatic, parabolic, or indirect diffusers), pendants (direct, indirect, or direct/indirect), high bay, low bay, and "aisle-lighter" fixtures. General lighting does not include display lighting (typically using directional MR, PAR, flood, spot, or wall washers) or decorative lighting (such as drum fixtures, chandeliers, or projection lighting.)
    - When there is only one lighting system type in a space, that system type will be treated as general lighting. Thus, light fixtures that might ordinarily be considered decorative or display luminaires are considered general lighting luminaires if they are the only system type in a given enclosed space.
6. Special Effects Lighting is lighting installed to give off luminance instead of providing illuminance, which does not serve as general, task, or display lighting.
7. Tunable white light source is capable of adjusting its correlated color temperature while maintaining its relative light output and capable of adjusting its light output while maintaining its correlated color temperature.
8. Wall Display Lighting is supplementary lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance required to highlight features, such as wall-mounted artwork, which is displayed on perimeter walls.
9. Window Display Lighting is lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance of objects such as artwork and artifacts, in a show window, to be viewed from the outside of a space.

«»

1. **Interior common use area lighting.** A building complies with Section 170.2(e)1 if:

   A. The calculation of adjusted indoor lighting power of all proposed building areas combined, calculated under Subsection 170.2(e)2, is no greater than the calculation of allowed indoor lighting power, specific methodologies calculated under Subsection 170.2(e)4; and

   B. The calculation of allowed indoor lighting power, general rules comply with Subsection 170.2(e)3.

   The prescriptive limits on indoor lighting power are the smaller of the actual and allowed indoor lighting power values determined in accordance with Item A.

2. **Calculation of Adjusted Indoor Lighting Power.** The Adjusted Indoor Lighting Power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions A through D of this subsection.

   A. **Two interlocked lighting systems**: No more than two lighting systems may be used for an area, and if there are two they must be interlocked. Where there are two interlocked lighting systems, the watts of the lower wattage system may be excluded from the Adjusted Indoor Lighting Power if:

      i. An installation certificate detailing compliance with Section 170.2(e)1A is submitted in accordance with Section 10-103 and Section 160.5(e); and

      ii. The area (or areas) served by the interlocking systems is an auditorium, a conference room, a multipurpose room or a theater; and

      iii. The two lighting systems are interlocked with a nonprogrammable double-throw switch to prevent simultaneous operation of both systems.

      For compliance with Part 6, a nonprogrammable double-throw switch is an electrical switch commonly called a "single pole double throw" or "three-way" switch that is wired as a selector switch allowing one of two loads to be enabled. It can be a line voltage switch or a low voltage switch selecting between two relays. It cannot be overridden or changed in any manner that would permit both loads to operate simultaneously.

«» Commentary for Section 170.2(e)2A:

Where there are two interlocked lighting systems (two lighting systems may be installed provided they are interlocked so that both lighting systems cannot operate simultaneously) the lower-wattage system may be excluded from determining the adjusted indoor lighting power under the following conditions:

1. The person who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the construction or installation of features, materials,

components, or manufactured devices must sign and submit the certificate of installation before two interlocked lighting systems will be recognized for compliance.

2. If any of the requirements in the certificate of installation are not met, the two interlocked lighting systems will not be recognized for compliance.
3. The two lighting systems shall be interlocked with a nonprogrammable double-throw switch to prevent simultaneous operation of both systems. For compliance with the Energy Code, a nonprogrammable double-throw switch is an electrical switch commonly called a "single pole double throw" or "three-way" switch that is wired as a selector switch allowing one of two loads to be enabled. It can be a line voltage switch or a low-voltage switch selecting between two relays. It cannot be overridden or changed in any manner that would permit both loads to operate simultaneously. **«»**

B. **Reduction of wattage through controls.** In calculating Adjusted Indoor Lighting Power, the installed watts of a luminaire providing general lighting in an area listed in Table 170.2-L may be reduced by the product of (i) the number of watts controlled as described in Table 170.2-L, times (ii) the applicable power adjustment factor (PAF), if all of the following conditions are met:

i. An installation certificate is submitted in accordance with Section 160.5(e)2; and

ii. Luminaires and controls meet the applicable requirements of Section 110.9 and Sections 160.5(b) through 160.6; and

iii. The controlled lighting is permanently installed general lighting systems and the controls are permanently installed nonresidential-rated lighting controls.

When used for determining PAFs for general lighting in offices, furniture mounted luminaires that comply with all of the following conditions shall qualify as permanently installed general lighting systems:

a. The furniture mounted luminaires shall be permanently installed no later than the time of building permit inspection; and

b. The furniture mounted luminaires shall be permanently hardwired; and

c. The furniture mounted lighting system shall be designed to provide indirect general lighting; and

d. Before multiplying the installed watts of the furniture mounted luminaire by the applicable PAF, 0.3 watts per square foot of the area illuminated by the furniture mounted luminaires shall be subtracted from installed watts of the furniture mounted luminaires; and

e. The lighting control for the furniture mounted luminaire complies with all other applicable requirements in Section 170.2(e)2B.

«» Commentary for Section 170.2(e)2B:

Section 170.2(e)2 of the Energy Code requires that all planned lighting, including portable and permanent lighting systems, be counted toward the lighting energy use of the common use area, regardless of when it is planned to be installed.

When the common use area includes offices with cubicles with portable lighting, the area category method include an additional lighting power provision is available. Because office cubicles (including their portable lighting) are typically not installed until after the building inspection is complete, the portable lighting power is counted together with the permanent lighting as the adjusted lighting power for compliance.

The Energy Code defines portable lighting as lighting with plug-in connections for electric power. That includes table and floor lamps, those attached to modular furniture, workstation task luminaires, luminaires attached to workstation panels, those attached to movable displays, or those attached to personal property. **«»**

iv. At least 50 percent of the light output of the controlled luminaire is within the applicable area listed in Table 170.2-L. Luminaires on lighting tracks shall be within the applicable area in order to qualify for a PAF.

v. Only one PAF from Table 170.2-L may be used for each qualifying luminaire. PAFs shall not be added together unless allowed in Table 170.2-L.

vi. Only lighting wattage directly controlled in accordance with Section 170.2(e)2B shall be used to reduce the installed watts as allowed by Section 170.2(e)2B for calculating the Adjusted Indoor Lighting Power. If only a portion of the wattage in a luminaire is controlled in accordance with Section 170.2(e)2B, then only that portion of controlled wattage may be reduced in calculating Adjusted Indoor Lighting Power.

vii. Lighting controls used to qualify for a PAF shall be designed and installed in addition to manual, multilevel and automatic lighting controls required in Section 160.5(b)4, and in addition to any other lighting controls required by any provision of Part 6. PAFs shall not be available for lighting controls required by Part 6.

viii. To qualify for the PAF for daylight continuous dimming plus OFF control, the daylight control and controlled luminaires shall comply with Sections 160.5(b)4D, 160.5(e)1C and 160.5(e)1G, and the controls shall be continuous dimming and shall additionally turn lights completely OFF when the daylight available in the daylit zone is greater than 150 percent of the illuminance received from the general lighting system at full power. The

PAF shall apply to the luminaires in the primary sidelit daylit zone, secondary sidelit daylit zone and skylit daylit zone.

ix. To qualify for the PAF for an occupant sensing control controlling the general lighting in large-office areas above workstations, in accordance with Table 170.2-L, the following requirements shall be met:

a. The office area shall be greater than 250 square feet; and

b. This PAF shall be available only in office areas that contain workstations; and

c. Controlled luminaires shall only be those that provide general lighting directly above the controlled area, or furniture mounted luminaires that comply with Section 170.2(e)1Aii and provide general lighting directly above the controlled area; and

d. Qualifying luminaires shall be controlled by occupant sensing controls that meet all of the following requirements, as applicable:

I. Infrared sensors shall be equipped by the manufacturer, or fitted in the field by the installer, with lenses or shrouds to prevent them from being triggered by movement outside of the controlled area.

II. Ultrasonic sensors shall be tuned to reduce their sensitivity to prevent them from being triggered by movements outside of the controlled area.

III. All other sensors shall be installed and adjusted as necessary to prevent them from being triggered by movements outside of the controlled area.

e. Occupant sensing control zones, in offices greater than 250 square feet, shall be shown on the plans.

x. To qualify for the PAF for an Institutional Tuning in Table 170.2-L, the tuned lighting system shall comply with all of the following requirements:

a. The lighting controls shall limit the maximum output or maximum power draw of the controlled lighting to 85 percent or less of full light output or full power draw; and

b. The means of setting the limit is accessible only to authorized personnel; and

c. The setting of the limit is verified by the acceptance test required by Section 160.5(e)1G; and

d. The construction documents specify which lighting systems shall have their maximum light output or maximum power draw set to no greater than 85 percent of full light output or full power draw.

xi. To qualify for the PAF for a demand responsive control in Table 170.2-L, the general lighting wattage receiving the PAF shall not be within the scope of Section 110.12(c) and a demand responsive control shall meet all of the following requirements:

a. The controlled lighting shall be capable of being automatically reduced in response to a demand response signal; and

b. General lighting shall be reduced in a manner consistent with the illuminance uniformity requirements of Section 160.5(b)4B.

xii. To qualify for the PAFs for clerestory fenestration, horizontal slats or light shelves in Table 170.2-L, the daylighting design shall meet the requirements in Section 170.2(b). The PAFs shall only apply to lighting in a primary or secondary sidelit daylit zone where continuous dimming daylighting controls meeting the requirements of Section 160.5(b)4D are installed.

TABLE 170.2-L LIGHTING POWER ADJUSTMENT FACTORS (PAF)

TYPE OF CONTROL	TYPE OF AREA	FACTOR
1. Daylight Continuous Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone	0.10
2. Occupant Sensing Controls in Office Spaces 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	0.30
	In open plan offices > 250 square feet: One sensor controlling an area that is: From 126 to 250 square feet	0.20
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
	Luminaires in daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.05
4. Demand Responsive Control	General lighting luminaires not in the scope of Section 110.12(c). If DR controls are required of Section 110.12(c), this PAF is not available for any lighting in the project. 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 daylit 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 daylit 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 daylit 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

«» Commentary for Section 170.2(e)2B:

The Energy Code provides an option for a lighting power reduction credit when specific lighting controls are installed, provided those lighting controls are not otherwise required. A power adjustment factor (PAF) is an adjustment to the installed lighting power in an area that allows some of the installed lighting power to not be counted toward the building's total installed lighting load. **«»**

C. Lighting wattage excluded. The watts of the following indoor lighting applications may be excluded from Adjusted Indoor Lighting Power:

i. Lighting installed by the manufacturer in walk-in coolers or freezers, vending machines and food preparation equipment.

ii. Lighting that is required for exit signs subject to the CBC. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.

iii. Exit way or egress illumination that is normally off and that is subject to the CBC.

iv. Temporary lighting systems.

v. Lighting systems in qualified historic buildings, as defined in the California Historical Building Code (Title 24, Part 8), are exempt from the lighting power density allowances if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems in qualified 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 lighting systems in qualified historic buildings shall comply with the lighting power density allowances.

vi. Lighting for signs shall comply with Section 170.2(e)7.

vii. Lighting in elevators where the lighting meets the requirements in Section 120.6(f).

viii. Lighting connected to a Life Safety Branch or Critical Branch, as specified in Section 517 of the California Electrical Code.

D. Luminaire classification and power adjustment.

i. Luminaire classification and power shall be determined in accordance with Section 160.5(b)1.

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

a. Small aperture. Qualifying luminaires with a luminaire aperture length longer than 18 inches shall have a luminaire aperture no wider than four inches. Qualifying luminaires with a luminaire aperture length of 18 inches or less shall have a luminaire aperture no wider than 8 inches.

b. Color changing. Qualifying tunable-white luminaires shall be capable of a color change greater than or equal to 2000 Kelvin correlated color temperature (CCT). Qualifying dim-to-warm luminaires shall be capable of color change greater than or equal to 500 Kelvin CCT.

c. Controls. Qualifying luminaires shall be connected to controls that allow color changing of the luminaires.

«» Commentary for Section 170.2(e)2D:

Color-tunable LED lighting technologies provide adjustable correlated color temperatures (CCT) to match the current use of a space or to reflect changes in time of day.

Two categories of color tunable luminaires – tunable-white LED and dim-to-warm LED luminaires – can qualify for a luminaire lighting power adjustment multiplier of 0.75 if the luminaires meet all of the requirements of Section 170.2(e)2Dii, described below.

1. Small Aperture: Luminaire aperture width no wider than 4 inches for an aperture length longer than 18 inches; aperture width no wider than 8 inches otherwise.
2. Color Changing Capability: Capable of color change greater than or equal to 2000K CCT for tunable-white LED luminaires; capable of color change greater than or equal to 500K CCT for dim-to-warm LED luminaires.
3. Controls: Connected to controls that allow color changing of the illumination.

Figure 6-26: Example of Dim-to-Warm Lighting: An Indoor Space With Dim-to-Warm Luminaires

Image Source: NORA Lighting

Figure 6-27: Relationship of Dimming to Change in Correlated Color Temperature of Dim-to-Warm (aka "WarmDim") Lighting Technology

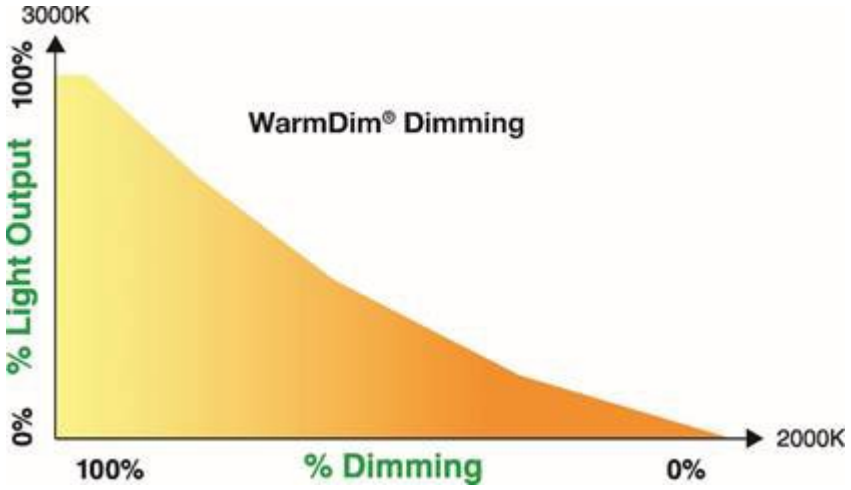


Image Source: Juno WarmDimming® Dimming courtesy of Acuity Brands Lighting, Inc.

«»

3. **Calculation of allowed indoor lighting power: general rules.**

   A. The allowed indoor lighting power allotment for conditioned areas shall be calculated separately from the allowed lighting power allotment for unconditioned areas. Each allotment is applicable solely to the area to which it applies, and there shall be no trade-offs between conditioned and unconditioned area allotments.

   B. The allowed indoor lighting power allotment shall be calculated separately from the allowed outdoor lighting power allotment. Each allotment is

applicable solely to the area to which it applies, and there shall be no trade-offs between the separate indoor and outdoor allotments.

C. The allowed indoor lighting power allotment for general lighting shall be calculated as follows:

i. The Area Category Method, as described in Section 170.2(e)4A, shall be used for all common use areas in the building. Under the Area Category Method as described more fully in Section 170.2(e)4A, and subject to the adjustments listed there, the allowed indoor lighting power allotment for general lighting shall be calculated for each area in the building as follows:

a. For conditioned areas, by multiplying the conditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 170.2-M.

b. For unconditioned areas, by multiplying the unconditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 170.2-M.

The allowed indoor lighting power allotment for general lighting for one area for which the Area Category Method was used may be increased up to the amount that the allowed indoor lighting power allotment for general lighting for another area using the Area Category Method, except that such increases and decreases shall not be made beeD. Additional lighting power allowances other than general lighting power allowances shall be restricted when using the Area Category Method. Additional lighting power allowances for display; decorative, wall display, floor display, or task, may not be increased as a result of, or otherwise traded off against, decreasing any other allotment.

«» Commentary for Section 170.2(e)3D:

Under the Area Category Method, an "area" is defined as all contiguous spaces that accommodate or are associated with a single primary function as listed in Table 170.2-M. For primary function areas not listed, selection of a reasonably equivalent type shall be permitted.

The Area Category Method divides the common use area into primary function areas. Each function area is defined in Section 100.1. The allowed lighting power is determined by multiplying the area of each function times the lighting power density for that function. Where areas are bounded or separated by interior partitions, the floor space occupied by those interior partitions shall be included in any area. The total allowed watts are the summation of the allowed lighting power for each area covered by the permit application.

When using this method, each common use function area must be included as a separate area. Boundaries between primary function areas may or may not consist of

walls or partitions. For example, common use kitchen and dining areas may or may not be separated by walls. For purposes of compliance, they must still be separated into two different function areas. However, it is not necessary to separate aisles or entries within primary function areas. When the Area Category Method is used to calculate the allowed total lighting power the main entry lobbies, corridors, restrooms, and support functions shall each be treated as separate function areas. **«»**

TABLE 170.2-M AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES (WATTS/FT²)

Primary Function Area	Allowed Lighting Power Density for General Lighting (W/ft²)	Additional Lighting Power Qualified Lighting Systems	Additional Lighting Power Additional Allowance (W/ft², unless noted otherwise)
Storage	0.4	NA	NA
Conference, Multipurpose and Meeting Area	0.75	Display	0.25
Conference, Multipurpose and Meeting Area	0.75	Wall Display MH <= 10’6”	2 W/ft
Conference, Multipurpose and Meeting Area	0.75	Wall Display MH 10’7”to 14’	2.35 W/ft
Conference, Multipurpose and Meeting Area	0.75	Wall Display MH > 14’	2.66 W/ft
Conference, Multipurpose and Meeting Area	0.75	Floor Display & Task MH <= 10’6”	0.30
Conference, Multipurpose and Meeting Area	0.75	Floor Display & Task MH 10’7” to 14’	0.35
Conference, Multipurpose and Meeting Area	0.75	Floor Display & Task MH > 14’	0.40
Copy Room	0.50	NA	NA
Corridor Area	0.40	Decorative/Display	0.25
Dining Area Bar/Lounge and Fine Dining	0.45	Display	0.35
Dining Area Bar/Lounge and Fine Dining	0.45	Wall Display MH <= 10’6”	1.25 W/ft
Dining Area Bar/Lounge and Fine Dining	0.45	Wall Display MH 10’7” to 14’	1.5 W/ft

Dining Area Bar/Lounge and Fine Dining	0.45	Wall Display MH > 14′	1.7 W/ft
Dining Area Bar/Lounge and Fine Dining	0.45	Floor Display & Task MH <= 10′6″	0.45
Dining Area Bar/Lounge and Fine Dining	0.45	Floor Display & Task MH 10′7″ to 14′	0.52
Dining Area Bar/Lounge and Fine Dining	0.45	Floor Display & Task MH > 14′	0.60
Dining Area Bar/Lounge and Fine Dining	0.45	General Lighting in the enclosed space of ceiling height > 10′	0.25
Dining Area Cafeteria/Fast Food	0.45	Display/Decorative	0.25
Dining Area Family and Leisure	0.40	Display/Decorative	0.25
Health Care / Assisted Living Nurse's Station	0.85	Tunable white or dim-to-warm[8]	0.10

TABLE 170.2-M AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES (WATTS/FT²) (Continue)

Primary Function Area	**Allowed Lighting Power Density for General Lighting (W/ft²)**	**Additional Lighting Power Qualified Lighting Systems**	**Additional Lighting Power Additional Allowance (W/ft², unless noted otherwise)**
Health Care / Assisted Living Physical Therapy Room	0.75	Tunable white or dim-to-warm[8]	0.10
Kitchen/Food Preparation Area	0.95	NA	NA
Electrical, Mechanical, Telephone Rooms	0.40	Detailed Task Work[1]	0.20
Exercise/Fitness Center and Gymnasium Area	0.50	NA	NA
Lobby, Main Entry	0.70	Display	0.25

Lobby, Main Entry	0.70	Wall Display MH <= 10'6"	3 W/ft
Lobby, Main Entry	0.70	Wall Display MH 10'7" to 14'	3.5 W/ft
Lobby, Main Entry	0.70	Wall Display MH > 14'	4 W/ft
Locker Room	0.45	NA	NA
Lounge, Breakroom, or Waiting Area	0.55	Display/Decorative	0.25
Concourse and Atria Area	0.60	Display/Decorative	0.25
Office Area > 250 square feet	0.60	Decorative/Display and Portable lighting for office areas[5]	0.20
Office Area ≤ 250 square feet	0.65	Decorative/Display and Portable lighting for office areas[5]	0.20
Parking Garage Area Parking Zone and Ramps	0.10	First ATM or Ticket Machine	100 W
Parking Garage Area Parking Zone and Ramps	0.10	Additional ATM or Ticket machine	50 W each
Parking Garage Area Daylight Adaptation Zones[3]	1.00	-	-
Laundry Area	0.45	-	-
Restrooms	0.65	Decorative/ Display	0.35
Stairwell	0.60	Decorative/ Display	0.35
All other	0.40	-	-
Aging Eye/Low-vision[6] Lobby, Main Entry	0.85	Display/Decorative	0.30
Aging Eye/Low-vision[6] Lobby, Main Entry	0.85	Transition Lighting OFF at night[7]	0.95
Aging Eye/Low-vision[6] Stairwell	0.80	Display/Decorative	0.30
Aging Eye/Low-vision[6] Corridor Area	0.70	Display/Decorative	0.30
Aging Eye/Low-vision[6] Lounge/Waiting Area	0.80	Display/Decorative	0.30
Aging Eye/Low-vision[6] Multipurpose Room	0.85	Display/Decorative	0.30
Aging Eye/Low-vision[6] Dining	0.80	Display/Decorative	0.30
Aging Eye/Low-vision[6] Restroom	1.00	Display/Decorative	0.20

Footnotes for this table are listed below.

1. Detailed task work – Lighting provides high level of visual acuity required for activities with close attention to small elements and/or extreme close up work.
2. MH denotes the luminaire mounting height of the qualified lighting systems.
3. Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage.
4. RESERVED
5. Portable lighting in office areas includes under shelf or furniture-mounted supplemental task lighting qualifies when controlled by a time clock or an occupancy sensor.
6. Aging Eye/Low-vision areas can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and are or will be licensed by local or state authorities for either senior long-term care, adult day care, senior support, and/or people with special visual needs.
7. Transition lighting OFF at night. Lighting power controlled by astronomical time clock or other control to shut off lighting at night. Additional LPD only applies to area within 30 feet of an exit. Not applicable to lighting in daylittTunable white luminaires capable of color change greater than or equal to 2000K CCT, or dim-to-warm luminaires capable of color change greater than or equal to 500K CCT, connected to controls that allows color changing of the luminaires.

4. Calculation of allowed indoor lighting power: specific methodologies. The allowed indoor lighting power for each common use primary function area shall be calculated using the following method.

A. Area Category Method. Requirements for using the Area Category Method include all of the following:

i. The Area Category Method shall be used only for primary function areas, as defined in Section 100.1, that are listed in Table 170.2-M. For primary function areas not listed, selection of a reasonably equivalent type shall be permitted.

ii. For purposes of compliance with Section 170.2(e)4A, an "area" shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in Table 170.2-M.

iii. Where areas are bounded or separated by interior partitions, the floor area occupied by those interior partitions may be included in a primary function area.

iv. The allowed indoor lighting power for each primary function area is the Lighting Power Density value in Table 170.2-M times the square feet of the primary function area. The total allowed indoor lighting power for the building is the sum of all allowed indoor lighting power for all areas in the building.

v. In addition to the allowed indoor lighting power calculated according to Sections 170.2(e)4Ai through iv, the building may add additional lighting power allowances for qualifying lighting systems as specified in the Qualifying Lighting Systems column in Table 170.2-M under the following conditions:

a. Only primary function areas having a lighting system as specified in the Qualifying Lighting Systems column in Table 170.2-M and in accordance with the corresponding footnote of the table shall qualify for the additional lighting power allowances; and

b. The additional lighting power allowances shall be used only if the plans clearly identify all applicable task areas and the lighting equipment designed to illuminate these tasks; and

c. Tasks that are performed less than two hours per day or poor quality tasks that can be improved are not eligible for the additional lighting power allowances; and

d. The additional lighting power allowances shall not utilize any type of luminaires that are used for general lighting in the building; and

e. RESERVED; and

f. The additional lighting power allowed is the smaller of:

   I. the lighting power density listed in the "Allowed Additional Lighting LPD" column in Table 170.2-M, times the square feet of the primary function, or

   II. the adjusted indoor lighting power of the applicable lighting; and

g. Floor displays shall not qualify for wall display allowances.

h. Qualifying wall lighting shall:

   I. Be mounted within 10 feet of the wall having the wall display. When track lighting is used for wall display, and where portions of that lighting track are more than 10 feet from the wall and other portions are within 10 feet of the wall, portions of track more than 10 feet from the wall shall not be used for the wall display allowance; and

   II. Be a lighting system type appropriate for wall lighting. Lighting systems appropriate for wall lighting are lighting track adjacent to the wall, wall-washer luminaai. Mounting height shall be the luminaire mounting height measured from the finished floor to the bottom of the luminaire. If luminaires are mounted at different mounting height within the same space, the average mounting height of the luminaires qualified for the additional lighting power allowances in Table 170.2-M can be used to establish the mounting height of the qualified luminaires for calculations of the additional lighting power allowances of the qualified luminaires.a«»
   Commentary for Section 170.2(e)4A:aAdditional lighting power allowance examples: A corridor may have a lighting system to provide both accent lighting and general lighting as illustrated in the following images about three different corridor scenarios.

Figure 6-28: Corridors With Accent Lighting and General Lighting: A Corridor With Wall Washer and Accent Luminaires (left image), a Corridor With Recessed Troffer Luminaires (center image), and a Corridor With Sconce Luminaires (right image)

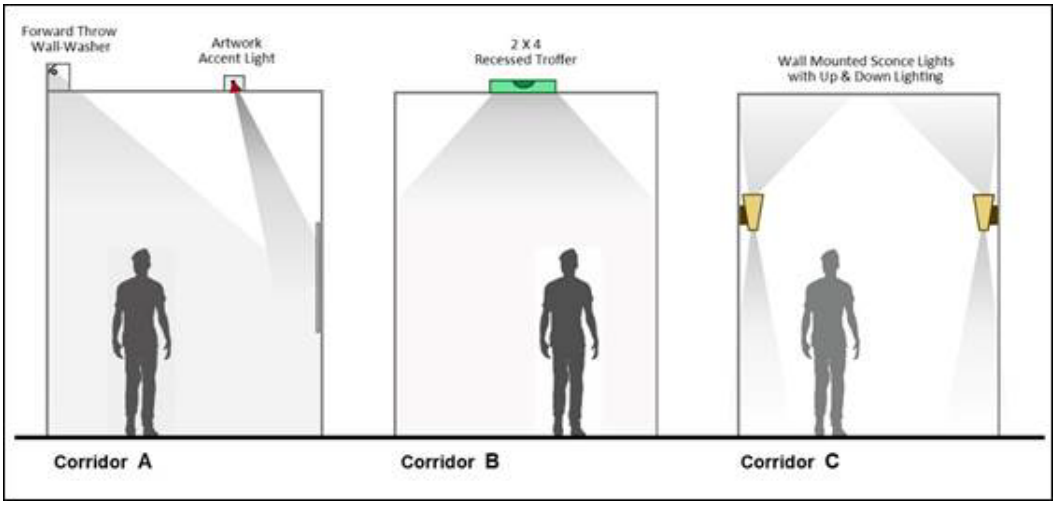


Image Source: Bernie Bauer

Corridor A has two lighting systems: forward wall-washers which provide the primary illumination and recessed accent lights for highlighting artwork. Wall-washers (asymmetric optics) are generally used as accent or feature lighting. However, in this scenario since they provide the general or ambient illumination, the lighting power for these luminaires is general lighting for corridor spaces. The artwork recessed accent lights are providing focal illumination to highlight the art. Therefore, the lighting power for these luminaires may be assigned to the decorative/display lighting allowance listed under the "Additional Lighting Power" column of Table 170.2-M.

Corridor B has one lighting system (2 by 4 recessed LED basket troffers) which provides all the illumination for the space. Basket troffers (symmetric wide distribution optics) are primarily to provide general or ambient illumination. Therefore, the lighting power for these luminaires must be assigned to the general lighting power allowance for corridor spaces. The decorative/display lighting allowance does not apply in this scenario as there are no luminaires providing directional illumination.

Corridor C has one lighting system: wall sconces that provide up-lighting on the ceiling for general /ambient illumination, but the sconces also include a downlight element. However, in this scenario since they provide the general or ambient illumination, the lighting power for these luminaires is general lighting. The decorative/display lighting allowance could also apply in this scenario. However, the up-light and downlight components of the luminaries must be placed on separate circuits. **«»**

5. RESERVED.
6. **Outdoor lighting.**
   A. A multifamily or mixed occupancy outdoor lighting installation complies with this section if it meets the requirements in Subsections 170.2(e)6B and C, and the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under Subsection 170.2(e)6D. The allowed outdoor lighting shall be calculated according to outdoor lighting zone in Title 24, Part 1, Section 10-114.

«» Commentary for Section 170.2(e)6A:

In a mixed use building with a multifamily occupancy, the multifamily outdoor lighting requirements described in this section are to be used for the entire site. **«»**

Exceptions to Section 170.2(e)6A: When more than 50 percent of the light from a luminaire falls within one or more of the following applications, the lighting power for that luminaire shall not be required to comply with Section 170.2(e)6:

i. Temporary outdoor lighting.
ii. Lighting required and regulated by the Federal Aviation Administration and the Coast Guard.
iii. Lighting for public streets, roadways, highways and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way owned or maintained by a local municipality or utility.
iv. Lighting for sports and athletic fields, and children's playgrounds.
v. Reserved.
vi. Lighting of public monuments.
vii. Lighting of signs complying with the requirements of Sections 160.5(d) and 170.2(e)7.
viii. Lighting of stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.
ix. Landscape lighting.
x. Reserved.
xi. 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.

xii. 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 buildings shall comply with Section 170.2(e)6.

B. Outdoor lighting power trade-offs. Outdoor lighting power trade-offs shall be determined as follows:

i. Allowed lighting power determined according to Section 170.2(e)6Di for general hardscape lighting allowance may be traded to specific applications in Section 170.2(e)6Dii, provided the hardscape area from which the lighting power is traded continues to be illuminated in accordance with Section 170.2(e)6Dia.

ii. Allowed lighting power determined according to Section 170.2(e)2Dii for additional lighting power allowances for specific applications shall not be traded between specific applications, or to hardscape lighting in Section 170.2(e)6Di.

iii. Trading off lighting power allowances between outdoor and indoor areas shall not be permitted.

C. Calculation of actual lighting power. The wattage of outdoor luminaires shall be determined in accordance with Section 160.5(b)1.

D. **Calculation of allowed lighting power.** The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accordance with Section 170.2(e)2Di, and the sum of the additional lighting power allowance for specific applications determined in accordance with Section 170.2(e)6Dii.

i. General hardscape lighting allowance. Determine the general hardscape lighting power allowances as follows:

a. The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s) and other improved area(s) that are illuminated. Public roadway(s) that are illuminated by a lighting system owned or maintained by the local municipality or utility shall not be included in the area calculations. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is ten times the luminaire mounting height with the luminaire in the middle of

the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines or obstructed by a structure. The illuminated hardscape area shall include portions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the Area Wattage Allowance (AWA) from Table 170.2-R for the appropriate lighting zone.

b. Determine the Initial Wattage Allowance (IWA) for general hardscape lighting from Table 170.2-R for the appropriate lighting zone. The hardscape area shall be permitted one IWA per site.

c. The general hardscape lighting allowance shall be the sum of the allowed watts determined from a and b above.

«» Commentary for Section 170.2(e)6D:

Allowed outdoor lighting power densities for multifamily buildings are structured using a layered approach. The first layer of allowed lighting power is general hardscape for the entire site. After the allowed lighting power has been determined for this first layer, additional layers of lighting power are allowed for specific applications when they occur on the site. The total allowed lighting power is the combined total of the allowed lighting power layers.

The allowed outdoor lighting power must be determined according to the outdoor lighting zone in which the site is located as defined in Section 10-114.

Figure 6-29: Concept of a Layered Lighting Approach for Outdoor Lighting - Lighting Power Allowance (LPA)

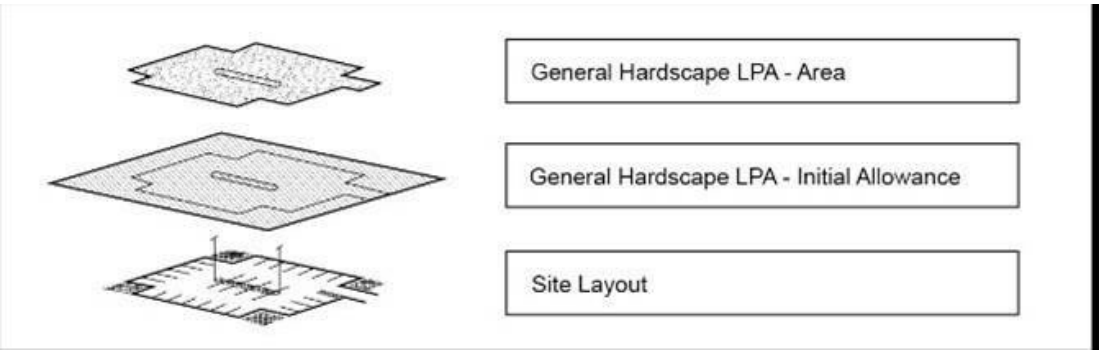


Image Source: Energy Solutions

The outdoor lighting applications addressed by the Energy Code are shown in the first two columns of Table 6-2: Scope of the Multifamily Outdoor Lighting Requirement. The first column is general site illumination applications which allow trade-offs within the outdoor portion only. The second column is specific outdoor lighting applications which

do not allow trade-offs and are considered "*use it or lose it*". The lighting applications in the third column are exempt from lighting power requirements. However, these lighting applications must meet applicable lighting control requirements.

For the purpose of determining outdoor lighting allowances, only those areas where lighting is provided are considered *illuminated areas*, excluding any areas that do not have luminaires, areas that are obstructed by any other structure or within a building, and any areas beyond the property line of the project site. The details of the process for determining the illuminated area for multifamily outdoor lighting are consistent with the requirements for nonresidential outdoor lighting.

Illuminated Area

For outdoor lighting applications, the number of luminaires, mounting heights and layout affect the presumed illuminated area and, therefore, the allowed lighting power.

1. The area of the lighting application may not include any areas on the site that are not illuminated. The area beyond the last luminaire is considered illuminated only if it is located within 5 mounting heights of the nearest luminaire.
2. In plan view of the site, the "illuminated area" is defined as any hardscape area within a square pattern around each luminaire or pole that is 10 times the luminaire mounting height, with the luminaire in the middle of the pattern. Another way to envision this is to consider an illuminated area from a single luminaire as the area that is 5 times the mounting height in four directions.
3. Illuminated areas shall not include any area that is obstructed by any other structure, including a sign, within a building, or areas beyond property lines.
4. The primary purpose for validating the illuminated area is to exclude any areas that are not illuminated. Areas that are illuminated by more than one luminaire shall not be double-counted. An area is either illuminated or it is not illuminated.
5. When luminaires are located farther apart (more than 10 times their mounting height apart), then the illuminated area stops at 5 times the mounting height of each luminaire.
6. Planters and small landscape areas are included within the general hardscape area if the short dimension of the inclusion is less than 10 ft. wide, and the inclusion is bordered on at least three sides by illuminated areas.
7. Landscape areas that are greater than 10 ft. wide in the short dimension are excluded from the general hardscape area calculation, but the perimeter of these exclusions may be included.

Figure 6-30: Calculating the Power Allowance for a Parking Lot

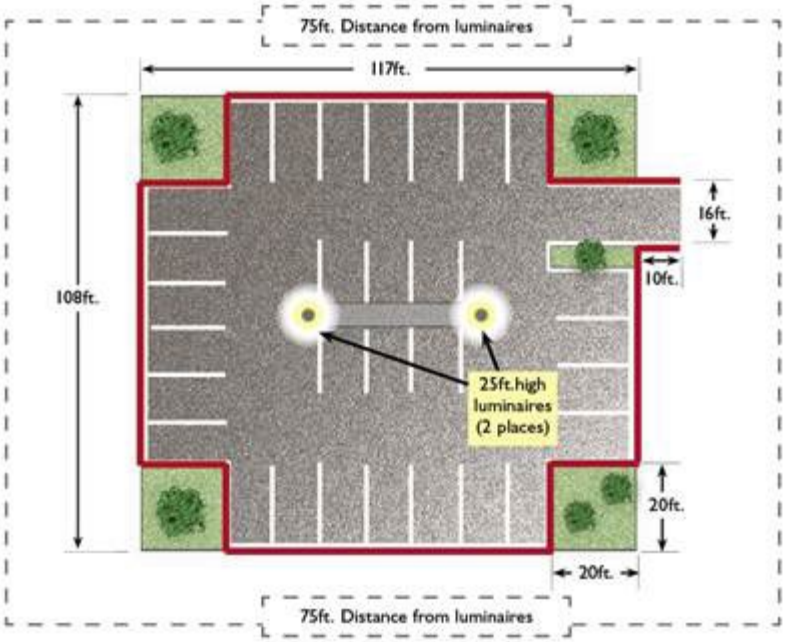


Image Source: California Energy Commission

Hardscape is defined in Section 100.1 as an improvement to a site that is paved and has other structural features, including but not limited to, curbs, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, water features and pools, storage or service yards, loading docks, amphitheaters, outdoor sales lots, and private monuments and statuary.

Table 6-2: Scope of the Multifamily Outdoor Lighting Requirement

General Hardscape (trade-offs permitted)	Specific Applications (trade-offs not permitted)	Lighting Applications Not Regulated
The general hardscape area of a site must include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s), and other improved area(s) that are illuminated.	Building Entrances or Exits Primary Entrances for Senior Care Facilities ATM Machine Lighting Hardscape Ornamental Lighting Building Facades Canopies Tunnels Outdoor Dining Special Security Lighting for Pedestrian Hardscape Security Cameras	Temporary outdoor lighting Required and regulated by FAA Required and regulated by the Coast Guard. For public streets, roadways, highways, and traffic signage lighting, and occurring in the public right-of-way Signs regulated by Section 160.5(d) and Section 170.2(e)7 For stairs and wheelchair elevator lifts For ramps that are not parking garage ramps Landscape lighting For qualified historic buildings

Source: California Energy Commission

«»

ii. **Additional lighting power allowance for specific applications.** Additional lighting power for specific applications shall be the smaller of the additional lighting allowances for specific applications determined in accordance with Table 170.2-S for the appropriate lighting zone, or the actual installed lighting power meeting the requirements for the allowance.

«» Commentary for Section 170.2(e)6D:

The lighting power allowances for specific applications provide additional lighting power that can be layered in addition to the general hardscape lighting power allowances as applicable.

Most of a site will be classified as general hardscape and will be calculated using Table 170.2-R as the only source of allowance. Additional allowances for specific applications can be per application, per hardscape area, per specific application unit length, or per

specific application area. Hardscape ornamental lighting is calculated independent of the rest of the specific applications. «»

TABLE 170.2-R GENERAL HARDSCAPE MULTIFAMILY LIGHTING POWER ALLOWANCE

Type of Power Allowance	Lighting Zone 0[2]	Lighting Zone 1[2]	Lighting Zone 2[2]	Lighting Zone 3[2]	Lighting Zone 4[2]
Area Wattage Allowance (AWA)	No allowance[1]	0.026 W/ft²	0.030 W/ft²	0.038 W/ft²	0.055 W/ft²
Initial Wattage Allowance (IWA)	No allowance[1]	300 W	350 W	400 W	450 W

Footnotes to TABLE 170.2-R:

1. Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 Watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse, or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed shall meet the maximum zonal lumen limits as specified in Section 160.5(c)1.
2. Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm – as mandated by local, state, or federal agg«» Commentary for Section 170.2(e)6D:

The 2025 Energy Code includes a lighting power provision for narrow band spectrum light source application to minimize the impact of electric light on local, active professional astronomy or nocturnal habitat of specific local fauna. The provision is in the format of lighting power multiplier as specified on the footnote of Table 170.2-R (footnote 2).

Narrow band spectrum light sources are those which have a spectral power distribution closely distributed around the wavelength of peak spectral power. There are no spectral power limitations on the wavelengths that are within 20 nm of the peak wavelength. As the spectrum diverges from the peak wavelength, the allowed relative spectral power declines rapidly.

1. Between 20 to 75nm from peak wavelength, the spectral power shall be no greater than 50% of the peak spectral power.
2. Beyond 75 nm the spectral power shall be no greater than 10% of the peak spectral power. This distribution is reflected in the narrow ban spectrum criteria line centered around the peak wavelength in Figure 6-31 Spectral Distribution with Narrow Band Criteria Superimposed.

Figure 6-31 Spectral Distribution with Narrow Band Criteria Superimposed

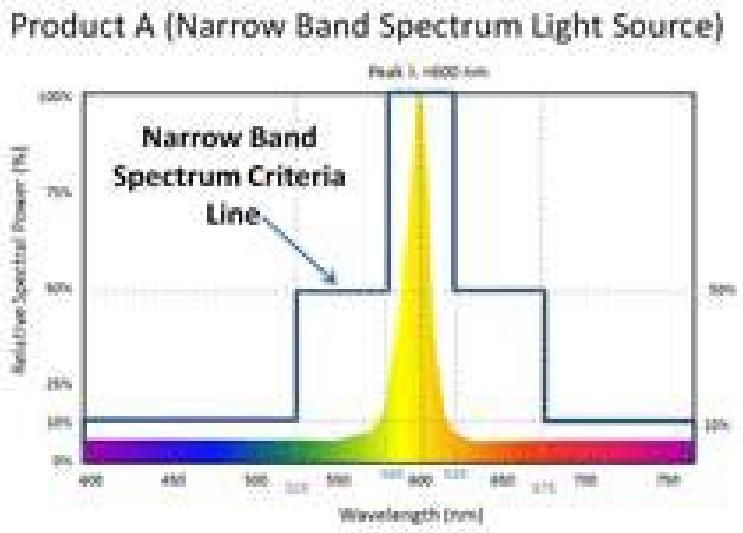


Image Source: Clanton Associates

«»

TABLE 170.2-S ADDITIONAL MULTIFAMILY LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS

All area and distance measurements in plan view unless otherwise noted.

PER APPLICATION: WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
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 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

ATM Lighting. Allowance per ATM. Luminaires qualifying for this allowance shall be within 50 feet of the dispenser.	Not applicable	100 watts for first ATM, 35 watts for each additional ATM.	100 watts for first ATM, 35 watts for each additional ATM	100 watts for first ATM, 35 watts for each additional ATM	100 watts for first ATM, 35 watts for each additional ATM

TABLE 170.2-S ADDITIONAL MULTIFAMILY LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS (continued)

All area and distance measurements in plan view unless otherwise noted.

PER APPLICATION: WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used for any illuminated hardscape area on the site.

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Hardscape Ornamental Lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 50 watts or less as determined in accordance with Section 160.5(b)1 and shall be post-top luminaires, lanterns, pendant luminaires, or chandeliers.	Not applicable	No Allowance	0.007 W/ft²	0.013 W/ft²	0.019 W/ft²

TABLE 170.2-S ADDITIONAL MULTIFAMILY LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS (continued)

All area and distance measurements in plan view unless otherwise noted.

PER APPLICATION: 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.

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Building Facades. Only areas of building façade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the façade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects. This allowance calculation shall not include portions of the building facades within 20 feet of residence bedroom windows.	Not applicable	No Allowance	0.100 W/ft²	0.170 W/ft²	0.225 W/ft²

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
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

TABLE 170.2-S ADDITIONAL MULTIFAMILY LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS (continued)

All area and distance measurements in plan view unless otherwise noted.

PER SITE: WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used as additional allowance for applicable illuminated hardscape area on the site.

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
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

TABLE 170.2-S ADDITIONAL MULTIFAMILY LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS (continued)

All area and distance measurements in plan view unless otherwise noted.

PER SITE: WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used as additional allowance for applicable illuminated hardscape area on the site.

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Security Camera. This additional allowance is for the 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

«» Commentary for Section 170.2(e)6D:

The lighting power allowances for specific applications provide additional lighting power that can be layered in addition to the general hardscape lighting power allowances, as applicable. Some portions of the site may fit use categories that permit the inclusion of an additional lighting allowance for that portion of the site. These specific applications are detailed in Table 170.2-S. Additional allowances for specific applications can be per application, per hardscape area, per specific application unit length, or per specific application area.

As noted previously, all these additional allowances are *use it or lose it* allowances and cannot be traded between applications or to general hardscape lighting. However, general hardscape lighting allowance may be traded to supplement these specific applications.

Building façade lighting is permitted in a similar manner as the nonresidential sections of the Energy Code. However, multifamily buildings have a specific stipulation to the facade lighting allowance that the allowance is not permitted to count areas of the facade that are within 20 feet of a bedroom window. This means design of the building facade will either have no facade lighting or the allowance will be smaller because of the excluded area from the allowance.

Other outdoor lighting applications that are not included in Energy Code Tables 170.2-R and 170.2-S are assumed to be not regulated by the Energy Code. This includes decorative gas lighting and emergency lighting powered by an emergency source as defined by the California Electrical Code.

Even if the lighting is exempted from the wattage allowance requirements, it is still subject to the lighting controls requirements that may apply to the respective lighting systems. **«»**

7. **Requirements for signs**. Section 170.2(e)7 applies to all internally illuminated and externally illuminated signs, unfiltered light emitting diodes (LEDs), and unfiltered neon, both indoor and outdoor. Each sign shall comply with either Subsection A or B, as applicable.

   A. **Maximum allowed lighting power.**

      i. For internally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot. For double-faced signs, only the area of a single face shall be used to determine the allowed lighting power.

      ii. For externally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 2.3 watts per square foot. Only areas of an externally lighted sign that are illuminated without obstruction or interference, by one or more luminaires, shall be used.

      iii. Lighting for unfiltered light emitting diodes (LEDs) and unfiltered neon shall comply with Section 170.2(e)7B.

   B. **Alternate lighting sources.** The sign shall be equipped with one or more of the following light sources:

      i. Reserved

      ii. Reserved

      iii. Neon or cold cathode lamps with transformer or power supply efficiency greater than or equal to the following:

         a. A minimum efficiency of 75 percent when the transformer or power supply rated output current is less than 50 mA; or

         b. A minimum efficiency of 68 percent when the transformer or power supply rated output current is 50 mA or greater.

      The ratio of the output wattage to the input wattage is at 100 percent tubing load.

      iv. Reserved

      v. Light emitting diodes (LEDs) with a power supply having an efficiency of 80 percent or greater; or

      Exception to Section 170.2(e)7Bv: Single voltage external power supplies that are designed to convert 120 volt AC input into lower voltage DC or AC output, and have a nameplate output power less than or equal to 250 watts, shall comply with the applicable requirements of the Appliance Efficiency Regulations (Title 20).

Exception 1 to Section 170.2(e)7: Unfiltered incandescent lamps that are not part of an electronic message center (EMC), an internally illuminated sign or an externally illuminated sign.

Exception 2 to Section 170.2(e)7: Exit signs. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.

Exception 3 to Section 170.2(e)7: Traffic signs that meet the requirements of the Appliance Efficiency Regulations, Sections 1601(m), 1602, 1602.1, 1603, 1604(m), 1605, 1605.1(m), 1605.2(m), 1605.3(m), 1606, 1607, 1608, and 1609.

«» Commentary for Section 170.2(e)7B:

Sign Lighting Compliance Options

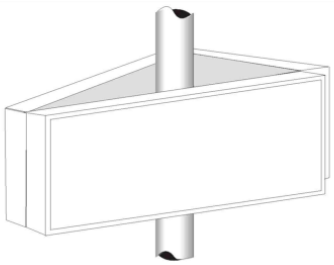
There are two options for complying with the sign lighting power requirements:

1. Maximum allowed lighting power (watts per square foot): The maximum allowed lighting power compliance approach limits allowed sign lighting power based on the illuminated sign area. When using this approach, there are rules in the Energy Code for classifying the lighting technology used and determining luminaire power. This compliance approach may be used for any light source type except unfiltered LED and unfiltered neon lighting.
2. List of compliant alternate lighting sources: The alternate lighting sources compliance approach specifies lighting technologies that may be used to meet the sign lighting power requirements. A sign is in compliance if it is equipped only with one or more of the listed light sources.

Internally and Externally Illuminated Signs

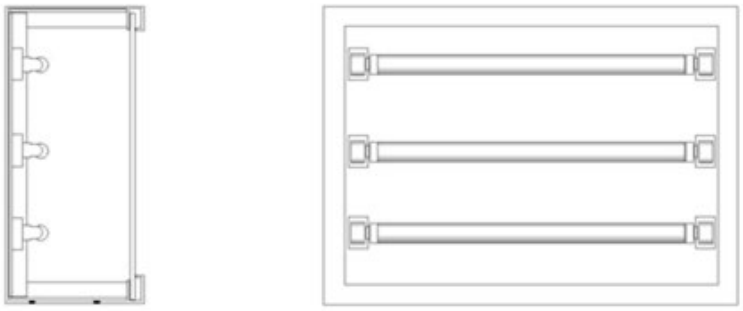
Internally illuminated signs (see Figure 6-32 Multifaced Sign, Figure 6-33: Single-Faced Internally Illuminated Cabinet Sign With Linear Lamps and Translucent Face, and Figure 6-34: Double-Faced Internally Illuminated Cabinet Sign With Linear Lamps and Translucent Faces) are defined in the Energy Code as signs that are illuminated by a light source that is contained inside a sign where the message area is luminous, including cabinet signs and channel letter signs.

Figure 6-32 Multifaced Sign



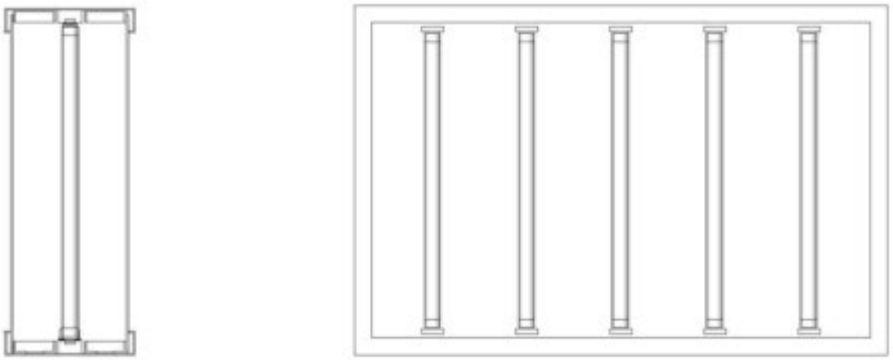
Source: California Statewide CASE Team

Figure 6-33: Single-Faced Internally Illuminated Cabinet Sign With Linear Lamps and Translucent Face



Source: California Statewide CASE Team

Figure 6-34: Double-Faced Internally Illuminated Cabinet Sign With Linear Lamps and Translucent Faces

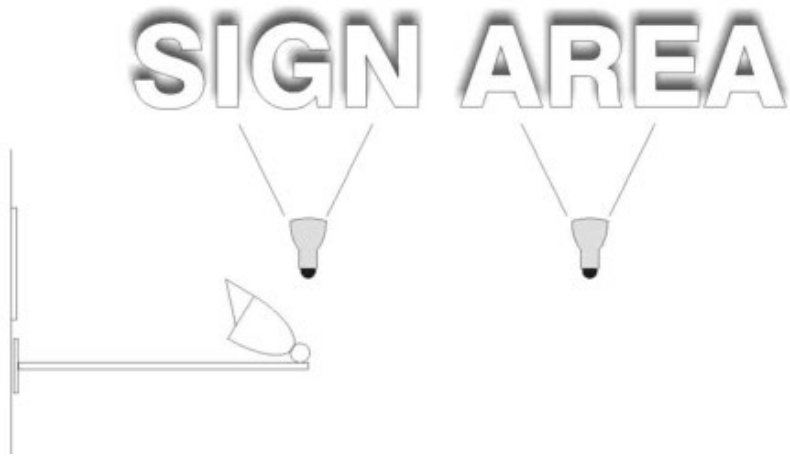


Source: California Statewide CASE Team

Externally Illuminated Signs

Externally illuminated signs (see Figure 6-35: Externally Illuminated Sign Using Flood Lighting) are defined in the Energy Code as any sign or billboard that is lit by a light source that is external to the sign directed toward and shining on the face of the sign.

Figure 6-35: Externally Illuminated Sign Using Flood Lighting

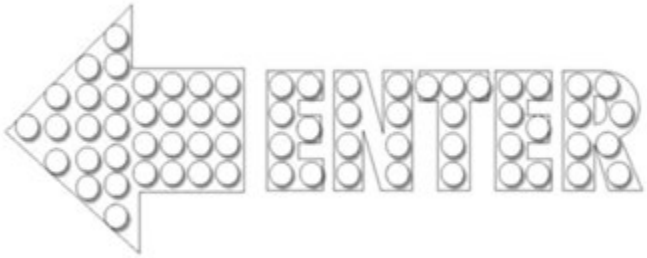


Source: California Statewide CASE Team

Hybrid Signs

A sign may consist of both regulated and non-regulated component. For example, a single sign structure may have a regulated internally illuminated cabinet, regulated externally illuminated letters attached to a brick pedestal, and unregulated unfiltered incandescent "chaser" lamps forming an illuminated arrow. Figure 6-36: Unfiltered Incandescent Sign shows an arrow, which is not part of an EMC using unfiltered incandescent lamps. If the lamps are not covered by a lens, then only the control regulations apply to the sign. This type of unfiltered incandescent sign is not regulated by Section 170.2(e)7.

Figure 6-36: Unfiltered Incandescent Sign



Source: California Statewide CASE Team

«»

SECTION 180.1 – ADDITIONS

Additions to existing multifamily buildings shall meet the applicable requirements of Sections 110.0 through 110.9; Sections 160.0, 160.1, and 160.2(c) and (d); Sections 160.3 through 160.7; and either Section 180.1(a) or 180.1(b).

«» Commentary for Section 180.1:

New additions, similar to newly constructed buildings, must meet all mandatory measures for the prescriptive and performance method of compliance. Prescriptive requirements, including the lighting power densities, must be met if the prescriptive method of compliance is used. If the performance approach is used and the new addition includes envelope or mechanical systems in the performance analysis, the lighting power densities in common use area conditioned spaces may be traded-off against other system energy budgets.

Outdoor lighting additions include adding illuminated area to an existing outdoor lighting site. The additional illuminated area must comply with all mandatory lighting control requirements and lighting power allowance requirements.

All new signs, regardless of whether they are installed in conjunction with an indoor or outdoor addition or alteration to a building or lighting system, must meet the Energy Code requirements. **«»**

(a) Prescriptive approach. The envelope and lighting of the addition; any newly installed space-conditioning or ventilation system, electrical power distribution system, or water-heating system; any addition to an outdoor lighting system; and any new sign installed in conjunction with an indoor or outdoor addition shall meet the applicable requirements of Sections 110.0 through 110.12**;** 160.0, 160.1, and 160.2(c) and (d); and 160.3 through 170.2.

(b) Performance approach. Performance calculations shall meet the requirements of Sections 170.0 through 170.2(a), pursuant to the applicable requirements in Items 1, 2 and 3 below.

1. **For additions alone.** The addition complies if the addition alone meets the energy budgets expressed in terms of Long-Term System Cost (LSC) energy.
2. **Existing plus alteration plus addition.** The standard design for existing plus alteration plus addition energy use is the combination of the existing building's unaltered components to remain; existing building altered components that are the more efficient, in LSC energy, of either the existing conditions or the requirements of Section 180.2(c); plus the proposed addition's energy use meeting the requirements of Section 180.1(a). The proposed design energy use is the combination of the existing building's unaltered components to remain and

the altered components' energy features, plus the proposed energy features of the addition.

Exception to Section 180.1(b)2: Existing structures with a minimum R-11 insulation in framed walls showing compliance with Section 180.1(b) are not required to show compliance with Section 160.1(b).

SECTION 180.2 – ALTERATIONS

Alterations to components of existing multifamily buildings, including alterations made in conjunction with a change in building occupancy to a multifamily occupancy, shall meet Item (a), and either Item (b) or (c) below:

(a) Mandatory requirements. Altered components in a multifamily building shall meet the minimum requirements in this section.

(b) Prescriptive approach. The altered component and any newly installed equipment serving the alteration shall meet the applicable requirements of Sections 110.0 through 110.9 and all applicable requirements of Sections 160.0, 160.1, 160.2(c) and (d), 160.3(a) through 160.3(b)5J, 160.3(b)6, 160.3(c) and 160.5; and

4. **Lighting**.

   A. **Dwelling unit lighting.** The altered lighting system shall meet the lighting requirements of Section 160.5(a). The altered luminaires shall meet the luminaire efficacy requirements of Section 160.5(a). Where existing screw base sockets are present in ceiling-recessed luminaires, removal of these sockets is not required, provided that new JA8 compliant trim kits or lamps designed for use with recessed downlights or luminaires are installed.

«» Commentary for Section 180.2(b)4A:

Dwelling unit lighting alterations must meet applicable mandatory requirements. There are no prescriptive lighting requirements for dwelling units.

Dwelling unit altered lighting and any newly installed lighting equipment are required to comply with the residential lighting standards, which apply to permanently installed lighting and associated lighting controls. Only the lighting equipment that is altered needs to comply with the Energy Code. Existing lighting equipment is not required to be replaced to comply. **«»**

   B. **Common use area—lighting, sign lighting, and electrical power distribution systems**.

      i. Spaces with lighting systems installed for the first time shall meet the applicable requirements of Sections 110.9, 160.5(b)1, 160.5(b)2, 160.5(b)3, 160.5(b)4, 160.5(c), 160.5(e), 170.2(b), and 170.2(e)1 through 170.2(e)6.

      ii. When the requirements of Section 160.5(b)4D are triggered by the addition of skylights to an existing building and the lighting system is not recircuited, the daylighting control need not meet the multi-level requirements in Section 160.5(b)4D.

iii. New internally and externally illuminated signs shall meet the requirements of Sections 110.9, 160.5(d) and 170.2(e)7.

iv. Altered indoor lighting systems. Alterations to indoor lighting systems that include 10% or more of the luminaires serving an enclosed space shall meet the requirements of a, b or c below:

a. The alteration shall comply with the indoor lighting power requirements specified in Sections 170.2(e)1 through 4 and the lighting control requirements specified in Table 180.2-E; or

b. The alteration shall not exceed 80% of the indoor lighting power requirements specified in Section 170.2(e)1 through 4, and shall comply with the lighting control requirements specified in Table 180.2-E; or

c. The alteration shall be a one-for-one luminaire alteration within a building or tenant space of 5,000 square feet or less, the total wattage of the altered luminaires shall be at least 40% lower compared to their total pre-alteration wattage and the alteration shall comply with the lighting control requirements specified in Table 180.2-E.

Alterations to indoor lighting systems shall not prevent the operation of existing, unaltered controls, and shall not alter controls to remove functions specified in SectiiAlterations 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 lighting on shared circuits or controls. New or completely replaced lighting circuits shall comply with the control separation requirements of Sections 160.5(b)4Aiv.i**Exception 1 to Section 180.2(b)4Biv:** Alteration of portable luminaires, luminaires affixed to moveable partitions, or lighting excluded as specified in Section 170.2(e)2C. i**Exception 2 to Section 180.2(b)4Biv:** Any enclosed space with only one luminaire.

Exception 3 to Section 180.2(b)4Biv: Any alteration that would directly cause the disturbance of asbestos unless the alteration is made in conjunction with asbestos abatement.

Exception 4 to Section 180.2(b)4Biv: Acceptance testing requirements of Section 160.5(e) are not required for alterations where lighting controls are added to control 20 or fewer luminaires.

Exception 5 to Section 180.2(b)4Biv: Any alteration limited to adding lighting controls or replacing lamps, ballasts or drivers.

Exception 6 to Section 180.2(b)4Biv: One-for-one luminaire alteration of up to 50 luminaires either per complete floor of the building or per complete tenant space, per annum.

«» Commentary for Section 180.2(b)4B:

Alterations to indoor lighting systems in multifamily common use areas that include 10 percent or more of the existing luminaires serving an enclosed space must meet the indoor lighting alteration requirements in Section 180.2(b)4Biv. Indoor lighting alterations include adding luminaires, removing and reinstalling luminaires, modifying luminaires, or combining the replacement of lamps and ballasts or drivers. **«»**

v. Alterations to existing outdoor lighting systems in a lighting application listed in Table 170.2-R or 170.2-S shall meet the applicable requirements of Sections 160.5(b)1, 160.5(b)2, 160.5(b)3, 160.5(c)1 and 160.5(e), and:

   a. In alterations that increase the connected lighting load, the added or altered luminaires shall meet the applicable requirements of Section 160.5(c)2 and the requirements of Section 170.2(e)6 for general hardscape lighting or for the specific lighting applications containing the alterations; and

   b. In alterations that do not increase the connected lighting load, where 10 percent or more of the existing luminaires are replaced in a general hardscape or a specific lighting application, the alterations shall meet the following requirements:

«» Commentary for Section 180.2(b)4B:

"Outdoor lighting alterations" generally refer to replacing entire luminaires or adding luminaires to an existing outdoor lighting system. Modifications or retrofitting existing luminaires (for example changing the luminaire light source) are not considered outdoor lighting alterations unless the modification increases the connected lighting load.

For alterations that do not increase connected lighting load and replace fewer than five luminaires or fewer than 10 percent of the existing luminaires, the replacement luminaires must comply with the luminaire shielding (BUG) requirements of Section 160.5(c)1. **«»**

   I. In parking lots and outdoor sales lots where the bottom of the luminaire is mounted 24 feet or less above the ground, the replacement luminaires shall comply with Section 160.5(c)2A and Section 160.5(c)2C;

   II. For parking lots and outdoor sales lots where the bottom of the luminaire is mounted greater than 24 feet above the ground and for all other lighting applications, the replacement luminaires shall comply with Section 160.5(c)2A and either comply with Section 160.5(c)2B or be controlled by lighting control systems, including motion sensors,

that automatically reduce lighting power by at least 40 percent in response to the area being vacated of occupants; and

Exception to Section 180.2(b)4Bvb: Alterations where less than 5 existing luminaires are replaced.

«» Commentary for Section 180.2(b)4B:

If fewer than five existing luminaires are replaced, the replacement luminaires are exempt from the control requirements for alterations to existing outdoor lighting systems. **«»**

c. In alterations that do not increase the connected lighting load, where 50 percent or more of the existing luminaires are replaced in general hardscape or a specific application, the replacement luminaires shall meet the requirements of Subsection b above and the requirements of Section 170.2(e)6 for general hardscape lighting or specific lighting applications containing the alterations.

Exception 1 to Section 180.2(b)4Bvc: Alterations where the replacement luminaires have at least 40 percent lower power consumption compared to the original luminaires are not required to comply with the lighting power allowances of Section 170.2(e)6.

Exception 2 to Section 180.2(b)4Bvc: Alterations where less than 5 existing luminaires are replaced.

Exception 3 to Section 180.2(b)4Bv: Acceptance testing requirements of Section 160.5(e) are not required for alterations where controls are added to 20 or fewer luminaires.

vi. Alterations to existing internally and externally illuminated signs that increase the connected lighting load, replace and rewire more than 50 percent of the ballasts, or relocate the sign to a different location on the same site or on a different site shall meet the requirements of Section 170.2(e)7.

Exception to Section 180.2(b)4Bvi: Replacement of parts of an existing sign, including replacing lamps, the sign face or ballasts, that do not require rewiring or that are done at a time other than when the sign is relocated, is not an alteration subject to the requirements of Section 180.2(b)4Bvi.

«» Commentary for Section 180.2(b)4B:

These requirements are not triggered when only the lamps are replaced, the sign face is replaced, or the ballasts are replaced without rewiring.

Sign ballast rewiring that triggers the alterations requirements generally involves rewiring from parallel to series or vice versa, or when a ballast(s) is relocated within the

same sign requiring relocating the wires. This does not include routine in-place ballast replacements. «»

vii. Alterations to existing electrical power distribution systems shall meet the applicable requirements of the following sections:

a. Service electrical metering. New or replacement electrical service equipment shall meet the requirements of Section 160.6(a) applicable to the electrical power distribution system altered; and

b. 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 Section 160.6(b); and

c. Voltage drop. For 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 Section 160.6(c); and

Exception to Section 180.2(b)4Bviic: Voltage drop permitted by California Electrical Code Sections 647.4, 695.6 and 695.7.

d. 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 Section 160.6(d).

«» Commentary for Section 180.2(b)4B:

"Entirely new or complete replacement" applies to the electrical power distribution system within the building and therefore effectively refers to the entire building. A modification of only part of the electrical power distribution system does not trigger the requirement.

For example, the scope of work for a tenant improvement project does not typically involve installing or replacing the entire electrical power distribution system; therefore, separation of electrical circuits would not typically be required.

Another example is a project where a portion of the system is upgraded for greater electrical capacity and the work scope includes replacement of panelboards, associated feeders, and overcurrent protection devices. This is not a complete replacement or entirely new electrical power distribution system, since there is existing equipment that is not changed or replaced.

Controlled receptacle and separation of electrical circuit requirements will apply only to alterations where there is an entirely new or complete replacement of the electrical power distribution system for the entire building. «»

TABLE 180.2-E Control Requirements for Indoor Lighting System Alterations for Common Use Areas

Control Specifications	**Projects complying with Section 180.2(b)4Biva**	**Projects complying with Sections 180.2(b)4Bivb or 180.2(b)4Bivc**
Manual Area Controls 160.5(b)4Ai	Required	Required
Manual Area Controls 160.5(b)4Aii	Required	Required
Manual Area Controls 160.5(b)4Aiii	Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Multilevel Controls 160.5(b)4B	Required	Not Required
Automatic Shut Off Controls 160.5(b)4Ci	Required	Required
Automatic Shut Off Controls 160.5(b)4Cii	Required	Required
Automatic Shut Off Controls 160.5(b)4Ciii	Required	Required
Automatic Shut Off Controls 160.5(b)4Civ	Required	Required
Automatic Shut Off Controls 160.5(b)4Cv	Required	Required
Automatic Shut Off Controls 160.5(b)4Cvi	Required	Required; except for 160.5(b)4Cvib

Daylight Responsive Controls 160.5(b)4D	Required	Not Required
Demand Responsive Controls 110.12(a) and 110.12(b)	Required	Not Required

(c) Performance approach. The altered component(s) and any newly installed equipment serving the alteration shall meet the applicable requirements of Subsections 1, 2 and 3 below. The energy budget for alterations is expressed in terms of Long-Term System Cost (LSC) energy.

1. The altered components shall meet the applicable requirements of Sections 110.0 through 110.9, 160.0, 160.1, 160.2(c) and (d), 160.3(a) through 160.3(b)5J, 160.3(b)6, 160.3(c), and 160.5. Entirely new or complete replacement mechanical ventilation systems as these terms are used in Section 180.2(b)5A shall comply with the requirements in Section 180.2(b)5A. Altered mechanical ventilation systems shall comply with the requirements of Sections 180.2(b)5B. Entirely new or complete replacement space-conditioning systems, and entirely new or complete replacement duct systems, as these terms are used in Sections 180.2(b)2Ai and 180.2(b)2Aiia, shall comply with the requirements of Sections 160.2(a)1 and 160.3(b)5L.
2. The standard design for an altered component shall be the higher efficiency of existing conditions or the requirements of Section 180.2(b). For components not being altered, the standard design shall be based on the unaltered existing conditions such that the standard and proposed designs for these components are identical. When the third-party verification option is specified, all components proposed for alteration for which the additional credit is taken, must be verified by a certified ECC-rater.
3. The proposed design shall be based on the actual values of the altered components.

NOTES TO SECTION 180.2(c):

1. If an existing component must be replaced with a new component, that component is considered an altered component for the purpose of determining the standard design altered component energy budget and must meet the requirements of Section 180.2(c)2.
2. The standard design shall assume the same geometry and orientation as the proposed design.
3. The "existing efficiency level" modeling rules, including situations where nameplate data is not available, are described in Section 10-109(c) and Section 10-116.

«» Commentary for Section 180.2(c):

If the performance approach is used and the alteration includes envelope or mechanical systems, the lighting power densities in common use area conditioned spaces may be traded-off against other system energy budgets. **«»**