Table of Contents

5 Nonresidential Indoor Lighting

This chapter covers the Energy Code requirements for indoor lighting design, installation, and controls for conditioned and unconditioned nonresidential buildings.

Chapter 6 addresses nonresidential outdoor lighting requirements.

Chapter 7 addresses sign lighting requirements.

5.1 Overview

The Energy Code requires that total lighting power is within a specified budget, and that lighting controls are installed for efficient operation of installed lighting.

5.1.1 What's New for the 2022 Energy Code?

Significant changes for indoor lighting systems in the 2022 update to the Energy Code include:

- Mandatory occupant sensing controls for office spaces greater than 250 square feet.
- Requirements for high-rise residential buildings that are moved to new multifamily chapters in the Energy Code.
- Automatic daylighting controls that must reduce controlled lighting power to 10 percent or less when adequate daylighting is available in a space.
- Automatic daylighting controls for secondary sidelit daylit zones becoming a mandatory requirement (previously prescriptive).
- Updates to the power adjustment factors in Table 140.6-A for daylight continuous dimming plus OFF controls, occupant sensing controls in offices larger than 250 sq. ft., and demand-responsive lighting controls.
- Lighting power allowances in the Area Category Method that have been combined for greater flexibility.
- Updates to lighting power density allowances in Table 140.6-B for the Complete Building Method.
- Updates to lighting power density allowances in Table 140.6-C for the Area Category Method.
- Updates to lighting power density allowances in Table 140.6-D and Table 140.6-G for the Tailored Method.
- Additional testing method for partial daylighting acceptance testing.

5.1.2 Scope

The nonresidential indoor lighting requirements are contained in §100.0, §110.9, §110.12, §120.8, §130.0, §130.1, §130.4, §140.0, §140.1, §140.3, §140.6, and §141.0 of the Energy Code. Supporting definitions are in §100.1.

- The nonresidential indoor lighting requirements apply to nonresidential buildings and hotel/motel occupancies (including guest rooms). Hotel/motel guest rooms are covered by portions of both the nonresidential indoor lighting requirements and the residential indoor lighting requirements. (See Chapter 6 of the 2022 Residential Compliance Manual.)
- Lighting requirements for multifamily buildings are covered in Chapter 11. Chapter 11 also covers multifamily buildings and residential spaces in mixed-use buildings.
- The nonresidential indoor lighting requirements are the same for conditioned and unconditioned spaces. Lighting power trade-offs are not allowed between conditioned and unconditioned spaces.
- Qualified historical buildings are regulated by the California Historical Building Code, not the Energy Code. However, nonhistorical components of such buildings may need to comply with the Energy Code. For more information, see Section 1.7.2.

All section and table references in this chapter refer to sections and tables contained in the Energy Code.

Refer to Chapter 6 of the Residential Compliance Manual Chapter 6 for information on lighting requirements for single-family residential buildings.

5.1.3 Functional Areas in Nonresidential Buildings That Must Comply With Applicable Residential Requirements

The following functional areas in nonresidential and hotel/motel occupancies are required to comply with the applicable residential lighting requirements in §150.0(k):

- Fire station dwelling accommodations
- Hotel and motel guest rooms

  Note that hotel and motel guest rooms are required to comply with §130.1(c)8, which requires captive card key controls, occupant sensing controls, or automatic controls. In addition, hotel and motel guest rooms are required to meet the controlled receptacle requirements of §130.5(d)4.

  EXCEPTION: One luminaire in a hotel or motel guest room that meets the following criteria is exempt from the control requirement:

- The luminaire is classified as high efficacy (as defined in §150.0[k] and Table 150.0-A).
- The luminaire is switched separately from the other lighting in the room.
- The switch for the luminaire is located within 6 feet of the entry door.

- Outdoor lighting attached to a hotel/motel building and separately controlled from inside a guest room.

Note that the above requirements also apply to additions and alterations to functional areas of existing buildings specified above.

5.1.4 Indoor Lighting Power Allotments Overview

Lighting power allotments are the established maximum lighting power that can be installed based on the compliance approach used, the building type, and building area. Lighting power allotments for an application are determined by one of the following four compliance approaches:

A. Prescriptive Approach – Complete Building Method

Applicable when the lighting system of an entire building is designed and permitted at one time and when at least 90 percent of the building is one nonresidential building occupancy type (as defined in §100.1). This method may also be used for a tenant space in a multitenant building if at least 90 percent of the tenant space is one building occupancy type. A single lighting power density value governs the entire building or tenant space.

B. Prescriptive Approach – Area Category Method

Applicable for any permit situation including tenant improvements. Lighting power density values are assigned to each of the primary function areas of a building (offices, lobbies, corridors, etc.) as defined in §100.1. This approach allows some flexibility to accommodate special task lighting needs by providing an additional power allowance under some circumstances.

C. Prescriptive approach – Tailored Method

Applicable for a limited number of defined primary function areas when additional flexibility is needed to accommodate special task lighting needs. Several layers of lighting power allotments may be allowed depending on the space and tasks. Lighting power allotments are determined room-by-room and task-by-task. Some areas in a building may use the Tailored Method while others use the Area Category Method.

D. Performance Approach

Applicable when the designer uses an California Energy Commission-certified compliance software program to demonstrate that the energy consumption of the

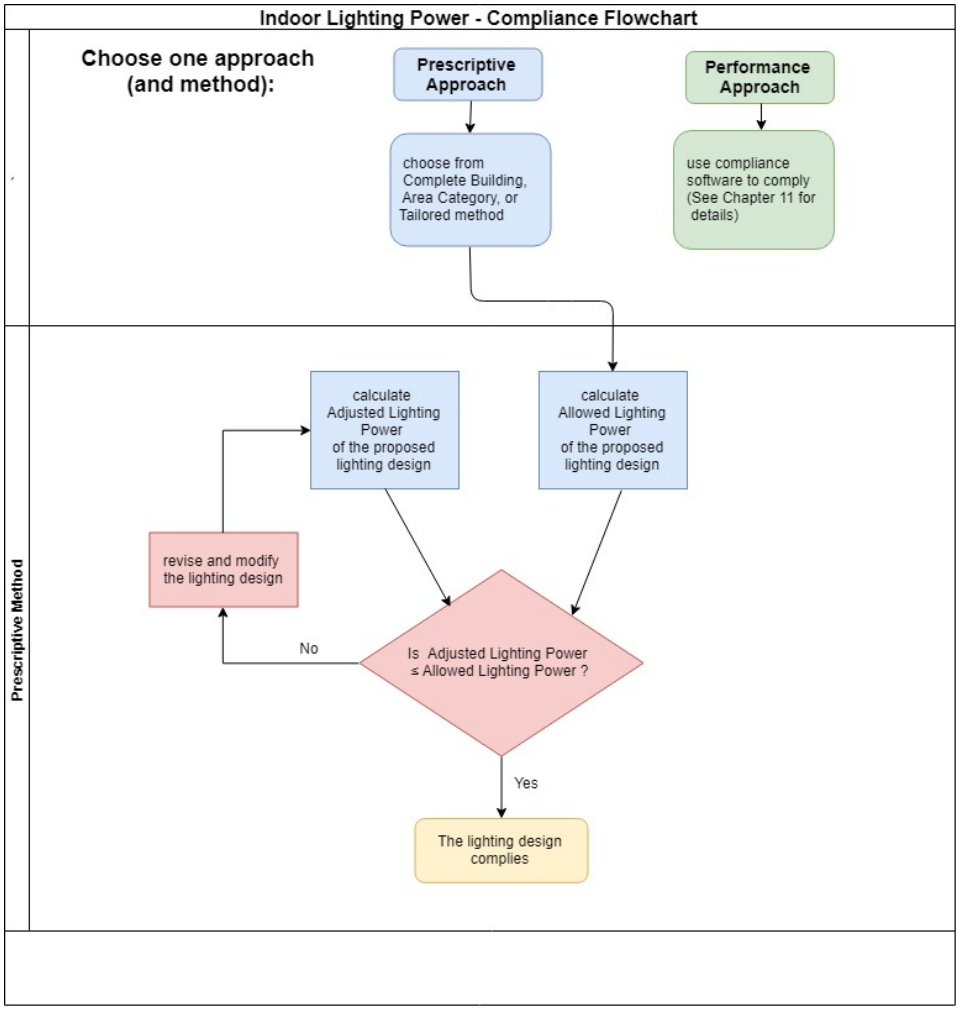
proposed building (including indoor lighting power) meets the energy budget. The performance approach incorporates one or more of the three previous methods, which establishes the custom energy budget of the building.

The performance approach allows energy allotments to be traded among space conditioning, mechanical ventilation, indoor lighting, service water heating, envelope, and covered process loads. Such trade-offs can be made only when permit applications are sought for those systems involved. For example, under the performance approach, a building with an envelope or mechanical ventilation system that is more efficient than the prescriptive efficiency requirements, may be able to meet the energy budget with more lighting power than allowed under the three prescriptive lighting approaches.

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. Therefore, the performance approach is not applicable to lighting compliance alone. The performance approach may be used only to model the performance of indoor lighting systems that are covered under the building permit application.

Figure 5-1 shows the process for complying with the nonresidential indoor lighting requirements.

Table 5-1: Indoor Lighting Power Compliance Overview Flowchart



Source: California Energy Commission

E. Choose an Indoor Lighting Power Compliance Approach (Refer to the Top Part of Figure 5-1):

First, select either the prescriptive or performance approach for complying with the nonresidential indoor lighting power requirements of the Energy Code.

For the performance approach, lighting power calculations can be performed using an approved software program. Refer to the compliance software documentation for details.

For the prescriptive approach, choose from among the Complete Building Method, the Area Category Method, or the Tailored Method.

Calculate the "allowed" lighting power using the chosen method. Allowed lighting power is the maximum lighting wattage that may be installed for the project (using lighting power values from Table 140.6-B, C, and D).

Next, calculate the "adjusted" lighting power. Adjusted lighting power is designed lighting power *minus* lighting control credits *minus* lighting power reduction.

F. Evaluate the Calculations — Allowed Lighting Power vs. Adjusted Lighting Power

If the adjusted lighting power is less than or equal to the allowed lighting power, the proposed lighting complies with the Energy Code.

If the adjusted lighting power is greater than the allowed lighting power, the proposed lighting does not comply with the Energy Code. To comply, the proposed lighting power must be reduced by redesigning the lighting system, or, if using the performance approach, additional lighting credits may be acquired through improved efficiency in other systems.

5.1.5 Compliance Process — Forms, Plan Check, Inspection, Installation, and Acceptance Tests

The compliance process begins with the builder submitting certificates of compliance to the responsible code enforcement agency. The certificates provide all design information necessary to show that the proposed project will comply with the Energy Code. Construction may not begin until all certificates of compliance are reviewed and approved by the enforcement agency.

As construction proceeds, builders must submit certificates of installation certifying that installed equipment and systems meet or exceed the design criteria specified in the approved certificates of compliance. Code enforcement officials may conduct field inspections to verify information submitted by builders. At the end of construction, acceptance tests must be performed by qualified contractors on all specified systems to ensure they are installed correctly and function per code requirements.

If inspections or acceptance tests identify noncompliant or nonfunctional systems, these defects must be fixed. Once the enforcement agency determines the project complies with all building code requirements, including the Energy Code, the building will receive a certificate of occupancy that certifies that the building complies with the building code.

5.2 General Requirements

Some requirements in the Energy Code are classified as "mandatory requirements" because they are required regardless of the compliance approach used. All projects must comply with all mandatory requirements.

It is the responsibility of the designer to design a lighting system and specify products that meet these requirements. It is the responsibility of the installer to install the lighting and controls specified on the plans. It is the responsibility of code

enforcement officials to verify that the mandatory requirements are included on the plans and installed in the field.

The mandatory requirements for nonresidential indoor lighting include the following:

- Certain functional areas in nonresidential buildings must comply with the low-rise residential lighting requirements in §130.0(b).
- Manufactured lighting equipment, products, and devices must be appropriately certified or meet functionality requirements in §110.0(b), §110.1, and §110.9(a).
- Requirements for how luminaires shall be classified (according to technology) and how luminaire power shall be determined in §130.0(c).
- Required indoor lighting controls in §130.1.
- Lighting control acceptance testing in §130.4(a).
- Lighting control certificates of installation in §130.4(b).

The Energy Code also includes mandatory requirements for electrical power distribution systems. See Chapter 8 for more information.

5.3 Luminaire Classification and Lighting Terms

§130.0(c)

Luminaires and light sources emit light and illuminate spaces. The Energy Code include a system of classification to account for the power of luminaires and lighting systems and use the information for assessing compliance.

Below is the list of luminaire types described and classified in §130.0(c):

- Luminaires with line-voltage lamp holders
- Luminaires with ballasts
- Inseparable solid-state lighting (SSL) luminaires and SSL luminaires with remote drivers
- LED tape lighting and LED linear lighting
- Modular lighting systems
- Other lighting equipment

The wattage of all planned lighting systems, including permanent and portable lighting, shall be determined as follows.

5.3.1 Luminaires With Line-Voltage Lamp Holders

The wattage of luminaires with line-voltage lamp holders not served by drivers, ballasts, or transformers shall be the maximum-rated wattage of the luminaire.

Figure 5-1: Examples of Luminaires With Line-Voltage Lamp Holders

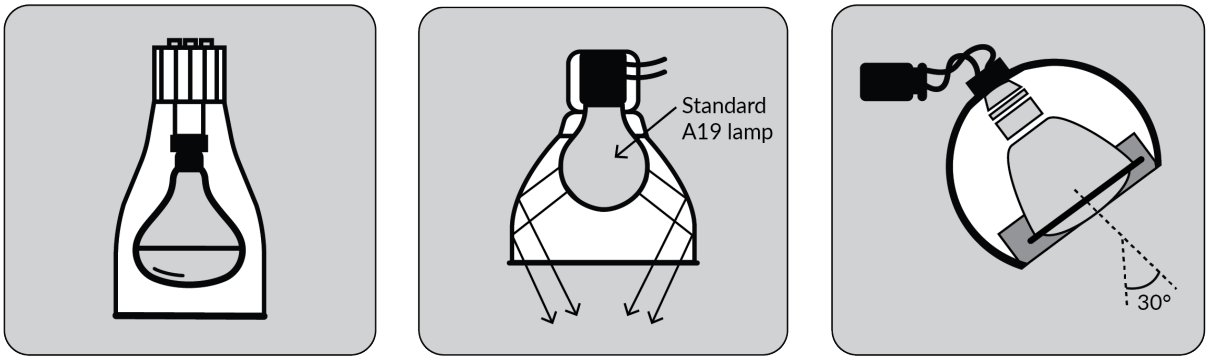


Image Source: Energy Solutions

5.3.2 Luminaires With Ballasts

The wattage of luminaires with permanently installed or remotely installed ballasts shall be the operating input wattage of the rated lamp/ballast combination.

This wattage information can be found in the ballast manufacturer's catalogs based on an independent testing lab report as specified in UL 1598.

5.3.3 Inseparable SSL Luminaires and SSL Luminaires With Remotely Mounted Drivers

The wattage of inseparable SSL luminaires and SSL luminaires with remote ballasts shall be the maximum-rated input wattage of the SSL luminaire.

Inseparable SSL luminaires are luminaires manufactured with solid-state lighting components that are not readily removed or replaced from the luminaires by the end users.

SSL luminaires shall be tested in accordance with UL 1598, 2108, or 8750, or IES LM-79.

Figure 5-2: Examples of SSL Luminaires: Recessed Downlight Luminaires

Image Source: Lutron Electronics Co., Inc.

5.3.4 LED Tape Lighting and LED Linear Lighting

LED tape lighting can be installed in varying lengths by installers on a project site as determined by the lighting design requirements. LED tape lighting is not like luminaires, which are manufactured in predetermined dimensions per customer order.

The wattage of LED tape lighting and LED linear lighting with LED tape lighting components shall be the sum of the installed length of the tape lighting times its rated linear power density in W/ft or the maximum-rated input wattage of the driver or power supply providing power to the lighting system.

Tape lighting shall be tested in accordance with UL 2108 or 8750, or IES LM-79.

Figure 5-3 Examples of LED Tape Lighting

Source: NORA Lighting

5.3.5 Modular Lighting Systems

Track-mounted and rail-mounted luminaires that allow the addition or relocation of luminaires without altering the wiring are examples of modular lighting systems. The wattage of these systems shall be determined as follows:

- The wattage shall be the greater of 30 watts per linear foot of track or plug-in busway or the rated wattage of all of the luminaires in the system (where the luminaire wattage is as specified by UL 1574, 1598, 2108, or 8750).
- For line-voltage track lighting and plug-in busway served by a track lighting current limiter, the wattage shall be the volt-ampere rating of the current limiter as specified by UL 1077.
- For line-voltage track lighting and plug-in busway served by a track lighting protection panel, the wattage shall be the sum of the ampere ratings of all the overcurrent protection devices times the branch circuit voltage for the track lighting protection panel.
- For other modular systems with power supplied by a driver, power supply, or transformer, including low-voltage lighting systems, the wattage shall be the maximum rated input wattage of the driver, power supply, or transformer as specified by UL 2108 or 8750.

- For power-over-Ethernet lighting systems, the wattage shall be the total power rating of the system less any installed nonlighting devices.

Figure 5-4 A Track Lighting System (top image); A Track Lighting Installation (bottom image)

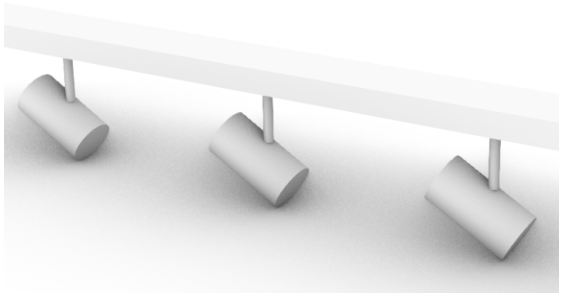


Image Source: California Energy Commission

Image Source: Acuity Brands Lighting, Inc.

5.3.6 Other Lighting Equipment

For lighting equipment not addressed above, the wattage of the lighting equipment shall be the maximum-rated wattage of the lighting equipment or the operating input wattage of the system, based on independent test lab reports as specified by UL-1547, 1598, 2108, or 8750, or IES LM-79.

Example 5-1 Power-Over-Ethernet Lighting

Question

What is a power-over-Ethernet (PoE) lighting system?

Answer

A PoE lighting system provides low-voltage direct current and communication over Ethernet cabling. By contrast, most conventional lighting systems use alternating current to power luminaires.

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.

Example 5-2 PoE Lighting

Question

What is the wattage of a PoE lighting system that contains a PoE switch, nine PoE luminaires, occupancy sensors, one daylight sensor, and wall switch stations?

Answer

One way to determine the answer is to account for the wattage of all the luminaires in the lighting system as the wattage of the PoE lighting system. Since there are nine PoE luminaires plus other nonlighting loads (sensors and switches), the wattage of the PoE lighting system is the sum of the wattage of all PoE luminaires, excluding the sensors and control switches.

Another way is to account for the total power rating of the system less any nonlighting devices such as occupancy sensors, sensing devices, and switch controls.

5.3.7 Lighting Terms

The following is a selection of lighting terms defined in §100.1 and included here to help readers understand the requirements.

A. General Lighting

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.)

B. Decorative, Display, Task, and Special Effects Lighting

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

- 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.
- *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.
- *Task lighting* is lighting directed to a specific surface or area providing illumination for visual tasks. Task lighting is not general lighting.
- *Special effects lighting* is lighting installed to give off luminance instead of providing illuminance, which does not serve as general, task, or display lighting.

Special effects lighting is different from decorative lighting. The only place special effects lighting is used is for the Decorative/Special Effects Lighting additional power allowance in the tailored method for lighting power compliance in Table 140.6-D where both terms are combined.

Both the Area Category Method (Table 140.6-C) and the Tailored Method (Table 140.6-D) provide additional lighting power allowances for lighting that is not considered general lighting; however, to claim these allowances, the nongeneral lighting systems must be separately switched.

For layered lighting designs with multiple luminaire types, compliance documentation will require allocating some or all nongeneral lighting power to the additional lighting power allowances and the rest of the lighting wattage to the general lighting power allowance. Only the general lighting power allowance is able to be shared across different spaces.

When there is only one lighting system type in a space, such as is the case when a monolithic design approach is taken, 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.

Example 5-3 LED Tape Lighting

LED tape lighting may be classified as Decorative Lighting, Task Lighting, or General Lighting, based on how it is used. Figure 5-5 shows two applications of LED tape lighting.

The image G3-A on the left shows LED tape lighting that is installed in a channel mounted to the underside of a shelf or cabinet or installed directly with adhesive

material. This use would be classified as display or task lighting. Such applications are not considered General Lighting.

The image G3-B on the right shows an architectural cove with tape lighting installed in a channel mounted within the cove or installed directly with adhesive material. This use may be classified as Decorative or Display Lighting or considered General Lighting, based on whether the illumination emanating from the cove is the only source of uniform lighting in the space.

Figure 5-5 Examples of LED Tape Lighting: In Use as Undershelf Lighting (left image); In Use as Cove Lighting (right image)

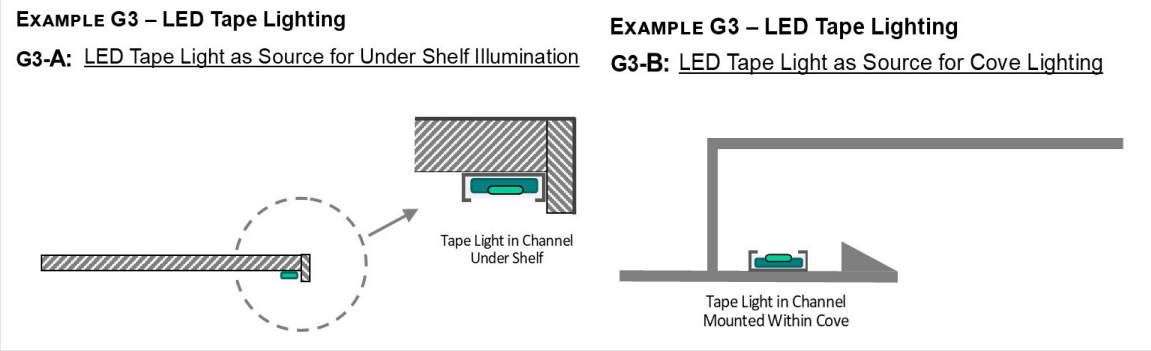


Image Source: Bernie Bauer

Example 5-4: Cove Lighting

Room A & Room B have two lighting systems: The first system consists of linear luminaires mounted in a cove to provide up-lighting bouncing off the ceiling and providing general illumination. The other system is a series of downlights providing task illumination over an alcove in the room. Cove lighting may be classified as decorative or display lighting when there are other luminaires providing general illumination. However, the cove lighting in this example also provides general illumination. Therefore, the cove lighting luminaire power is applied to the allowed general lighting LPD shown in Table 140.6-C Area Category Method or Table 140.6-D Tailored Method instead of as a decorative or display allowance from Table 140.6-C or 140.6-D. The lighting power of the downlights providing task illumination are assigned to Additional Lighting Power in Table 140.6-C or Allowed Task Lighting Power in Table 140.6-D, provided they are on a separate circuit. If they are on the same circuit as the cove lights, they must also be included in the base lighting allowance.

Room C has three lighting systems:

1) Asymmetric distribution luminaires mounted in a cove to provide up-lighting bouncing off the ceiling for visual enhancement.
2) A grid of flood downlights designed to provide general illumination.
3) A series of downlights providing task illumination over two alcoves in the room. Cove lighting in this scenario may be classified as decorative or display lighting

and can use the decorative/display allowances shown in Table 140.6-C or the decorative/special effects allowance in Table 140.6-D, provided one is available for the space type in which the cove is located, and the cove is separately circuited from the downlights. The flood downlights are designed to provide general/ambient illumination; therefore, the general lighting LPD allowances in Table 140.6-C or 140.6-D apply. As with the cove lights, the downlights providing task illumination can use the appropriate additional allowances in Table 140.6-C or 140.6-D, provided one is available and they are separately circuited.

Figure 5-6 Examples of Cove Lighting: Asymmetric Distribution Luminaires in Cove (Room C); Linear Luminaires in Cove (Rooms A and B)

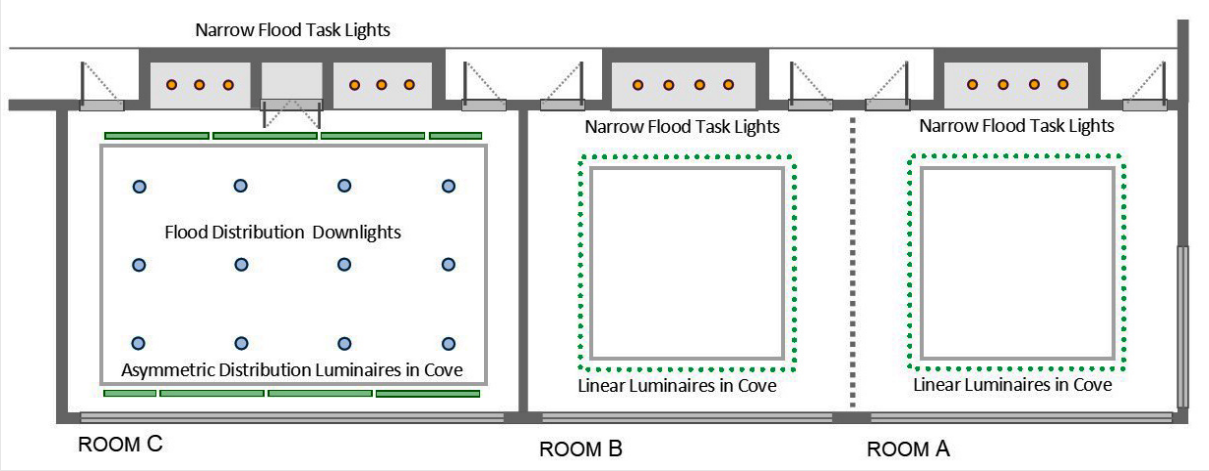


Image Source: Bernie Bauer

5.4 Mandatory Lighting Controls

§130.1

This section contains information about lighting controls that must be installed regardless of the method used to comply with the lighting power requirements**.**

All lighting controls and equipment must comply with the applicable requirements in §110.9, 130.1, 130.2, and must be installed in accordance with the manufacturer's instructions (§130.0(d)).

Mandatory nonresidential indoor lighting controls include the following:

1. Manual area controls, allowing on and off control for each area separately.
2. Multilevel controls, allowing the ability to use all, some, or none of the light in an area.

3. Shut-off controls, which, automatically shut off or reduce light output when a space is vacant.
4. Automatic daylighting controls, which separately control general lighting in the daylit area based on the amount of daylight in the space.
5. Demand-responsive lighting controls, which are capable of receiving and automatically responding to a demand response signal.

5.4.1 Manual Area Controls

§130.1(a) of Part 6; §10-103(a)2 of Part 1

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

The manual area controls shall meet the following requirements:

1. Be readily accessible.

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

2. Be located in the same enclosed area with the lighting it controls.

   EXCEPTION 1: For malls and atria, main entry lobbies, auditorium areas, dining areas, retail merchandise sales areas, wholesale showroom areas, commercial and industrial storage areas, general commercial and industrial work areas, convention centers, arenas, psychiatric and secure areas in healthcare facilities, and other areas where placement of a manual area control poses a health and safety hazard, the manual area control shall instead be located so that a person using the control can see the lights or area controlled by that control, or visually signal or display showing the current state of the controlled lighting.

   EXCEPTION 2: Healthcare facility restrooms and bathing rooms intended for a single occupant can have lighting controls located outside the enclosed area but directly adjacent to the door.

3. Separately control general, floor display, wall display, window display, case display, decorative, and special effects lighting such that each type of lighting can be turned on and off without turning on or off other types of lighting or other equipment. 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.

For egress lighting required by the California Building Code, up to 0.1 W/sq. ft. of indoor lighting may be continuously illuminated during occupancy. Egress lighting that complies with this wattage limitation is not required to comply with manual area control requirements if:

1. The means of egress area is shown on the building plans and specifications submitted to the local enforcement agency under Section 10-103(a)2 of Part 1 (California Code of Regulations Title 24).
2. The egress lighting controls are inaccessible to unauthorized personnel.

5.4.2 Multilevel Lighting Controls

§130.1(b) & Table 130.1-A

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

This requirement applies to general lighting in enclosed spaces 100 sq. ft. or larger with a connected general lighting load greater than 0.5 W/sq. ft. General lighting does not include task, display, or decorative lighting.

The multilevel control must meet the minimum required control steps and uniformity requirements in Table 130.1-A. The minimum required control steps are determined by the type of light source or luminaire being controlled.

For some light sources and luminaires, dimming can be implemented in steps or over a continuous range. Continuous dimming provides a smoother transition of light levels compared to stepped dimming.

Classrooms with a connected general lighting load of 0.6 W/sq. ft. or less shall have a minimum of one control step between 30 percent and 70 percent of full rated power, regardless of luminaire type.

EXCEPTION: The following applications are not required to comply with the multilevel lighting control requirements:

1. An area enclosed by ceiling height partitions with only one luminaire containing no more than two lamps or with only one inseparable SSL luminaire
2. Restrooms
3. Healthcare facilities

Table 5-2 (From Table 130.1-A): Multilevel Lighting Controls and Uniformity Requirements

Luminaire Type	Minimum Required Control Steps (percent of full rated power1)	Uniform level of illuminance shall be achieved by:
LED luminaires and LED light sources	Continuous dimming 10-100%	Continuous dimming 10-100%
Line-voltage sockets except GU-24	Continuous dimming 10-100%	Continuous dimming 10-100%
Low-voltage incandescent systems	Continuous dimming 10-100%	Continuous dimming 10-100%
Fluorescent luminaires	Continuous dimming 20-100%	Continuous dimming 20-100%
GU-24 sockets rated for fluorescent ≤ 20 watts Pin-based compact fluorescent ≤ 20 watts2 Linear fluorescent and U-bent fluorescent ≤ 13 watts	Minimum one step between 30-70%	Continuous dimming or Stepped dimming or Switching alternate lamps in a luminaire or Separately switching circuits in multicircuit track with a minimum of two circuits.
Track Lighting	Minimum one step between 30 – 70%	Continuous dimming or Stepped dimming or Separately switching circuits in multicircuit track with a minimum of two circuits.
Linear Fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range: 20 – 40% 50 – 70% 75 – 85% 100%	Stepped dimming or Continuous dimming or Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire, illuminating the same area in the same manner.
Other light sources, including HID and Induction	Minimum one step between 50 – 70%	Stepped dimming or Continuous dimming or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner.

1. Full rated input power of driver, ballast, and lamp, corresponding to maximum ballast factor.
2. Includes only pin-based twin tube, multiple twin tube, and spiral lamps.

5.4.3 Shut-Off Controls

§130.1(c)

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

EXCEPTION: Healthcare facilities are not required to meet the shut off control requirements.

Shut off controls can be used to automatically turn off or reduce lighting when the spaces are not occupied. For example, an office building is typically unoccupied at night and on weekends; automatic shutoff controls ensure that lighting is off during these periods.

In addition to lighting controls installed to comply with §130.1(a) (manual on and off controls located in each area) and §130.1(b) (multilevel lighting controls) , all installed indoor lighting shall be equipped with shut off controls that meet the following requirements (§130.1[c]1):

1. One or more of the following automatic shut off controls:
    - Occupant sensing control
    - Automatic time-switch control
    - Other control capable of automatically shutting off all lighting when the space is typically unoccupied
2. Separate controls for lighting on each floor, other than lighting in stairwells
3. Separate controls for a space 5,000 square feet or smaller enclosed by ceiling-height partitions. Spaces larger than 5,000 square feet will have more than one separately controlled zone (where each zone does not exceed 5,000 square feet)

    EXCEPTION: The area controlled may not exceed 20,000 square feet in the following function areas: malls, auditoriums, single-tenant retail, industrial, convention centers, and arenas

The following applications are exempt from the shut off control requirements of §130.1(c)1:

- An area that is in 24-hour use every day of the year.
- Lighting complying with the occupant sensing control requirements of §130.1(c)5 instead of §130.1(c)1.
    - This exception applies to those areas where occupant sensing controls are required to shut off all lighting. These areas include offices 250 sq. ft. or smaller, multipurpose rooms of less than 1,000 sq. ft., classrooms of any size, conference rooms of any size, or restrooms of any size.

- Lighting complying with the partial- off occupant sensing control requirements of §130.1(c)7 instead of §130.1(c)1.
    - This exception applies to those areas where partial off occupant sensing controls are required. These areas include stairwells and common area corridors that provide access to guestrooms and dwelling units in accordance with §130.1(c)7A, or parking garages, parking areas, and loading and unloading areas in accordance with §130.1(c)7B.
- Lighting up to 0.1 watts per sq. ft. may be continuously illuminated for egress illumination. Lighting providing "egress illumination," as used in the California Building Code, shall provide no less light than required by California Building Code Section 1008 while in the partial-off mode.
- Electrical equipment rooms covered by Article 110.26(D) of the California Electrical Code.
- Lighting that is designated as emergency lighting that is connected to an emergency power source or battery supply and intended to function in emergency mode only when normal power is absent.

5.4.3.1 Use of Countdown Timer Switches

Countdown timer switches may be used to comply with the automatic shut off control requirements in §130.1(c)1 only in closets smaller than 70 sq. ft. and server aisles in server rooms.

The maximum timer setting shall be 10 minutes for closets and 30 minutes for server aisles.

5.4.3.2 Automatic Time-Switch Controls With Manual Override

Automatic time-switch controls other than an occupant sensing control shall include a manual override control that complies with §130.1(a) and allows the lighting to remain on for no more than two hours when an override is initiated.

EXCEPTIONS: In the following functional areas, the override time may exceed two hours if a captive-key override is used:

- Malls
- Auditoriums
- Single-tenant retail
- Industrial
- Laboratories
- Arenas

5.4.3.3 Automatic Time-Switch Control Holiday Shut Off Feature

An automatic holiday shut off feature shall be incorporated with the automatic time-switch control that turns off all loads for at least 24 hours, and then resumes the normally scheduled operation.

EXCEPTIONS: The following are not required to incorporate the holiday shut off feature:

- Retail stores and associated malls
- Restaurants
- Grocery stores
- Churches
- Theaters

5.4.3.4 Areas Where Occupant Sensing Controls are Required to Shut Off All Lighting After Occupancy

§130.1(c)5

Lighting in the following areas 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 addition, controls shall be provided that allow the lights to be manually shut off in accordance with §130.1(a) regardless of the sensor status:

a. Offices 250 sq. ft. or smaller
b. Multipurpose rooms smaller than 1,000 sq. ft.
c. Classrooms of any size
d. Conference rooms of any size
e. Restrooms of any size

In areas required by §130.1(b) to have multilevel lighting controls, the occupant sensing controls shall function as one of the following:

a. A partial-on occupant-sensing control capable of automatically activating between 50 and 70 percent of controlled lighting power (requires lights to be turned ON manually to 100 percent) and automatically turning lights off when the space is unoccupied
b. A vacancy-sensing control that automatically turns lights off after an area is vacated and requires lights to be turned on manually

For areas not required by §130.1(b) to have multilevel lighting controls, occupant sensing controls may function as one of the following:

a. A normal occupant-sensing control with automatic on and off functionality
b. A partial-on occupant-sensing control
c. A vacancy-sensing control

Figure 5-7: Functional Diagram for Partial-ON Occupant Sensor

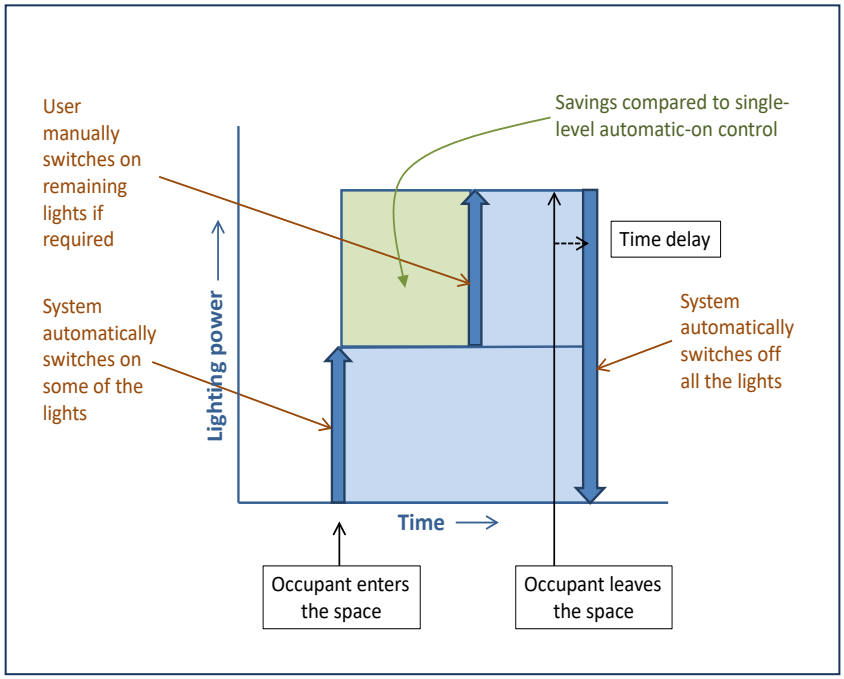


Image Source: California Energy Commission

Offices larger than 250 sq. ft. are required to be equipped with an occupant sensing control that manages the HVAC thermostat setup, setback, and ventilation (§120.1[d]5 and §120.2[e]3). 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 §120.1(d)5, §120.2(e)3, and §130.1(c), 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).

5.4.3.5 Areas Where Full or Partial-Off Occupant Sensing Controls Are Required in Addition to Complying With §130.1(c)1

§130.1(c)6

In addition to the basic shut off requirements in §130.1(c)1, §130.1(c)6 requires full- or partial off occupant sensing controls to turn off or reduce lighting when an area is unoccupied.

In warehouse aisle ways and open areas, certain library book stack aisles, stairwells, and corridors, lighting power must reduce by at least 50 percent when the areas are unoccupied. The decision to reduce or turn lighting off may be made by the designer.

Lighting in these spaces must also comply with §130.1(c)1, which requires lighting to be capable of shutting off when the building is unoccupied. If a partial off occupancy sensor is used to reduce lighting when a space is unoccupied, it can be paired with an automatic time switch to shut lighting off when the building is typically unoccupied.

Figure 5-8 Functional Diagram for Partial Off Occupant Sensor

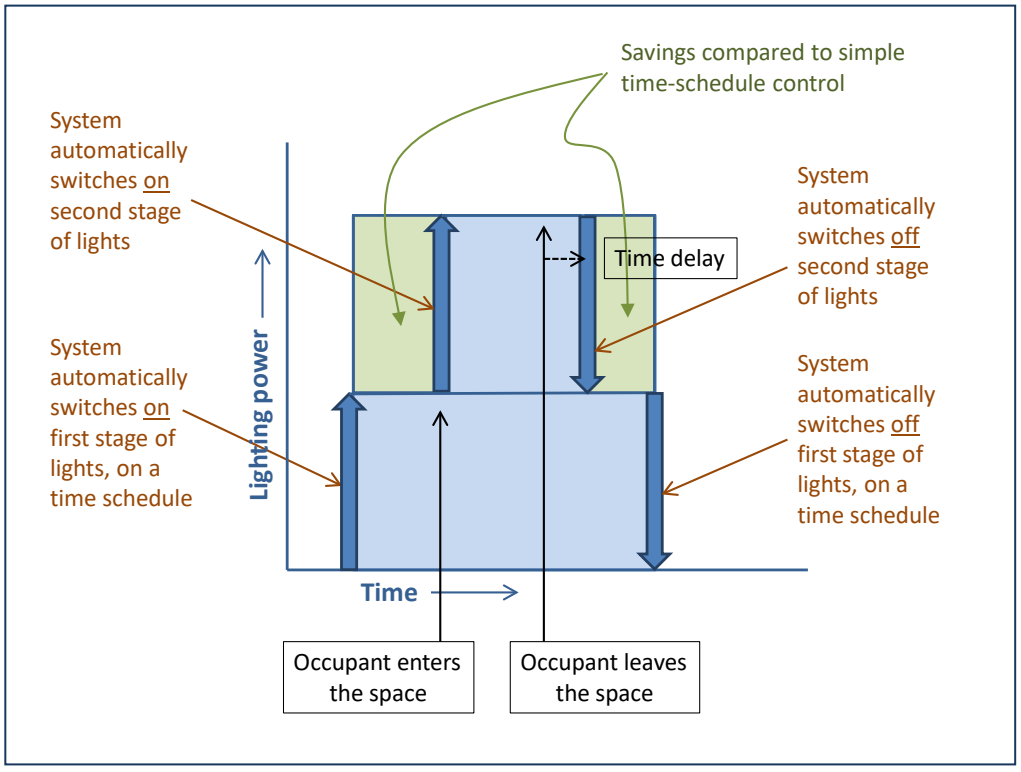


Image Source: California Energy Commission

A. In aisle and open areas in warehouses, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls

must have independent zoning for each aisle, and the aisle zones must not extend beyond the aisle into the open area of the warehouse.

EXCEPTIONS: The following conditions exempt the lighting system from this requirement, but it must meet the additional listed requirements:

1. In aisle ways and open areas in warehouses in which the installed lighting power is 80 percent or less of the value allowed under the Area Category Method, occupant sensing controls shall reduce lighting power by at least 40 percent (instead of the 50 percent required above).
2. When metal halide lighting or high-pressure sodium lighting is installed in warehouses, occupant sensing controls shall reduce lighting power by at least 40 percent (instead of the 50 percent required above). This exception is due to limitations of dimming or bilevel ballast technology for high-intensity discharge (HID) light sources.

B. In the following library book stack aisles, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied:

1. Library book stack aisles 10 feet or longer that are accessible from only one end
2. Library book stack aisles 20 feet or longer that are accessible from both ends

The occupant sensing controls shall independently control lighting in each aisle way and shall not control lighting beyond the aisle way being controlled by the sensor.

C. 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 turning the lighting fully on automatically only in the separately controlled space and shall be automatically activated from all designed paths of egress.

D. In office spaces greater than 250 sq. ft., general lighting shall be controlled by occupant sensing controls that meet all of the following requirements. These requirements apply exclusively to luminaires providing general lighting. Luminaires not meant to provide general lighting can either be controlled following the same occupant sensing controls requirements as general lighting, or be controlled as specified in §130.1(c)1 using time-switch controls or separate occupant sensing controls.

i. The occupant sensing controls shall be configured so that lighting is controlled separately in control zones not greater than 600 sq. ft. For luminaires with an embedded occupant sensor capable of reducing power independently from other luminaires, each luminaire can be considered its own control zone.

ii. In 20 minutes or less after the control zone is unoccupied, the occupant sensing controls shall uniformly reduce lighting power in the control zone by at least 80 percent of full power. Control functions that switch control zone lights completely off when the zone is vacant meet this requirement.

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

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 the mandatory occupant sensing controls for offices greater than 250 sq. ft.: Under-shelf or furniture-mounted task lighting that is already controlled by a local switch and either a time clock or an occupancy sensor does not need to be included in the control zones of the occupant sensing controls.

Example 5-5: An Office With Luminaires Serving Different Lighting Purposes

An office of 2,584 square feet has three types of luminaires, as shown in the figure below:

1.Overhead luminaires providing general lighting to the cubicles (the 28 purple rectangles).

2.Linear lights over display cases near the wall highlighting the objects in the cases (bottom left and right).

3.Wall wash lighting along the wall highlighting artwork (bottom center).

Only the overhead luminaires providing general lighting are subject to the occupant sensing control requirements in §130.1(c)6D. Different approaches and options to meet the requirements are discussed in the next example. The linear display lighting and wall wash are grouped together and controlled by a time clock to comply with the shut off requirements in §130.1(c)1.

Figure 5-9 (for Example 5-5) An Office Plan With Occupant Sensing Control Zone Layout

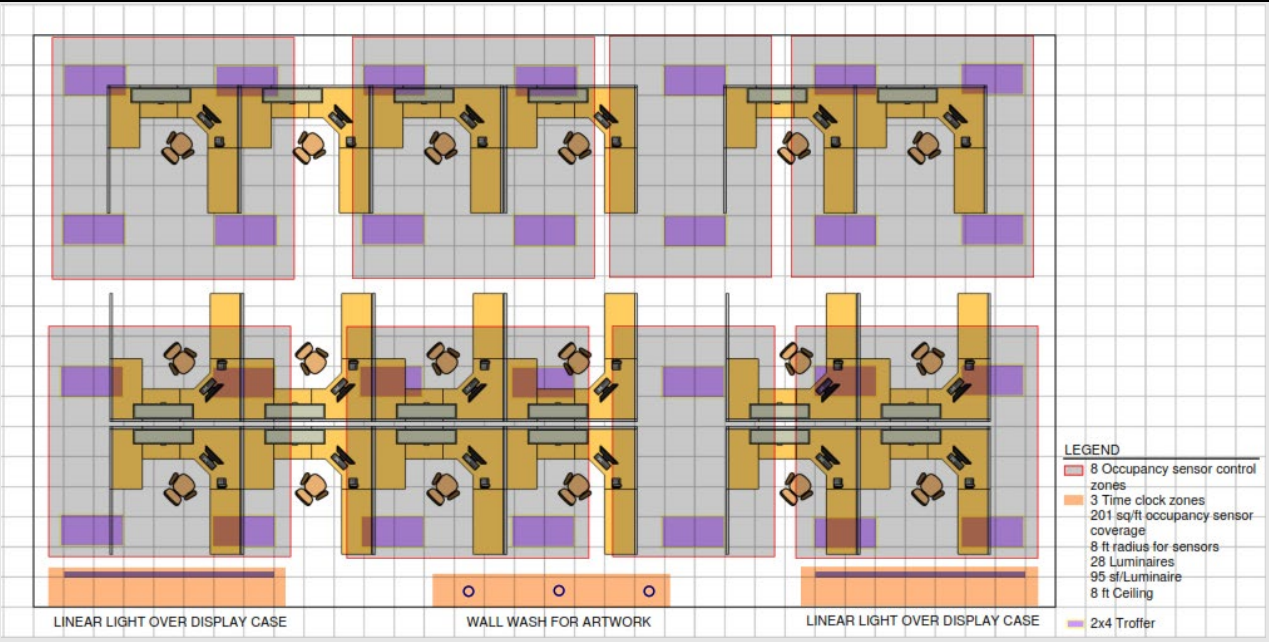


Image Source: Energy Solutions

Example 5-6: 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.

The figure below provides an example of the same 2,584 square foot office as in the previous example 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 §140.6(a)2I for occupant sensing controls in offices larger than 250 square feet. Refer to Section 5.6.2 for more information on the PAF.

Figure 5-10 (for Example 5-6) An Office Plan With Occupant Sensing Control Zone Layout

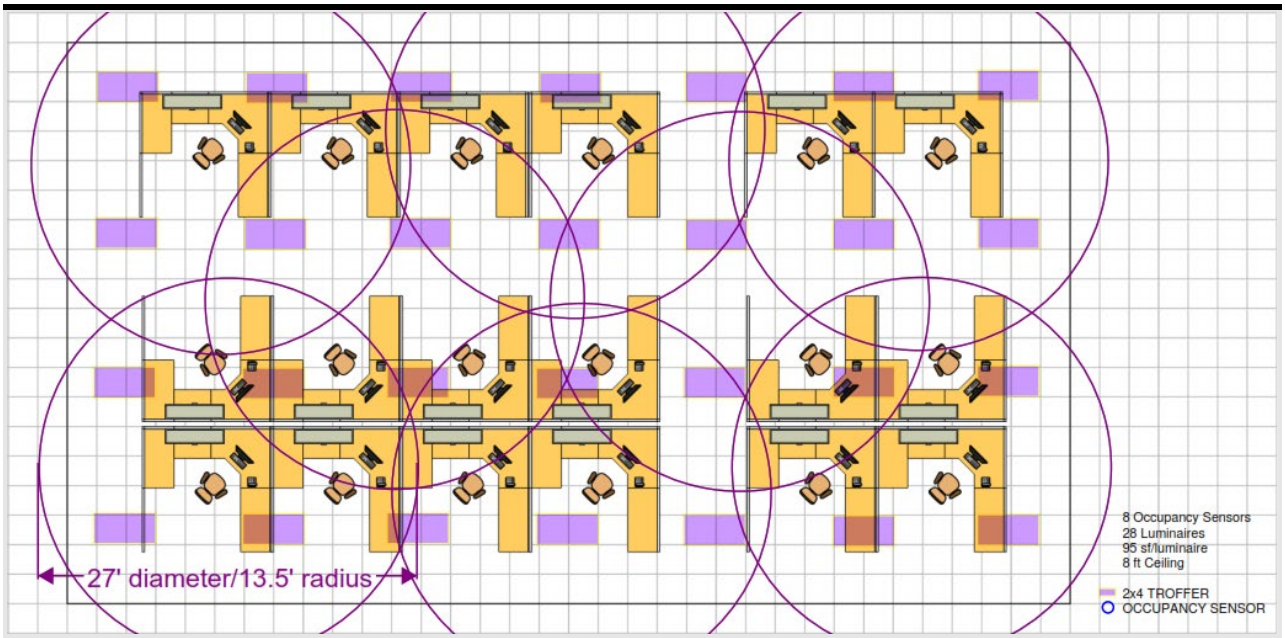


Image Source: Energy Solutions

Example 5-7: Occupant Sensing Control Zone in a Large Office Using Power Adjustment Factor

The figure 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 140.6-A. Refer to §140.6(a)2I and Section 5.6.2 of this compliance manual for detailed requirements on using the PAF for occupant sensing controls in offices larger than 250 square feet.

Note: 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 the figure below had a coverage area greater than 250 sq. ft., the design would not qualify to use the PAF.

Figure 5-11 (for Example 5-7) An Office Plan With Occupant Sensing Control Zone Layout

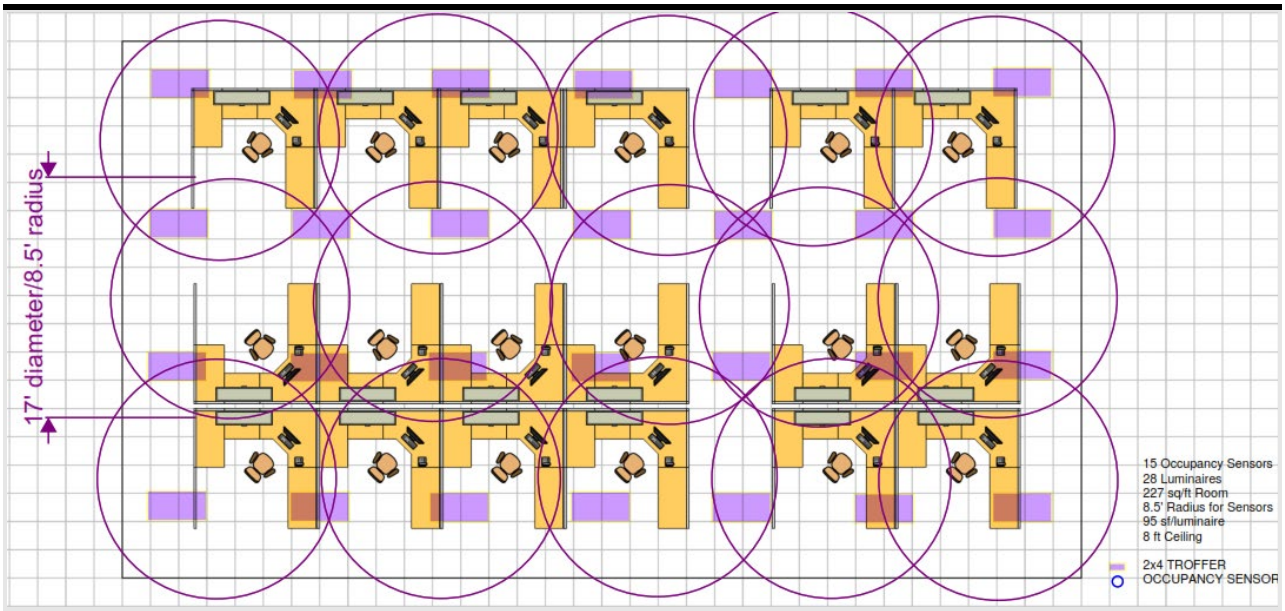


Image Source: Energy Solutions

Example 5-8: 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 §140.6(a)2I for occupant sensing controls in offices larger than 250 square feet. Refer to Section 5.6.2 for more about using the PAF.

Note: 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.

The figure 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 140.6-A).

Figure 5-12 (for Example 5-8): An Office Plan With Occupant Sensing Control Zone Layout

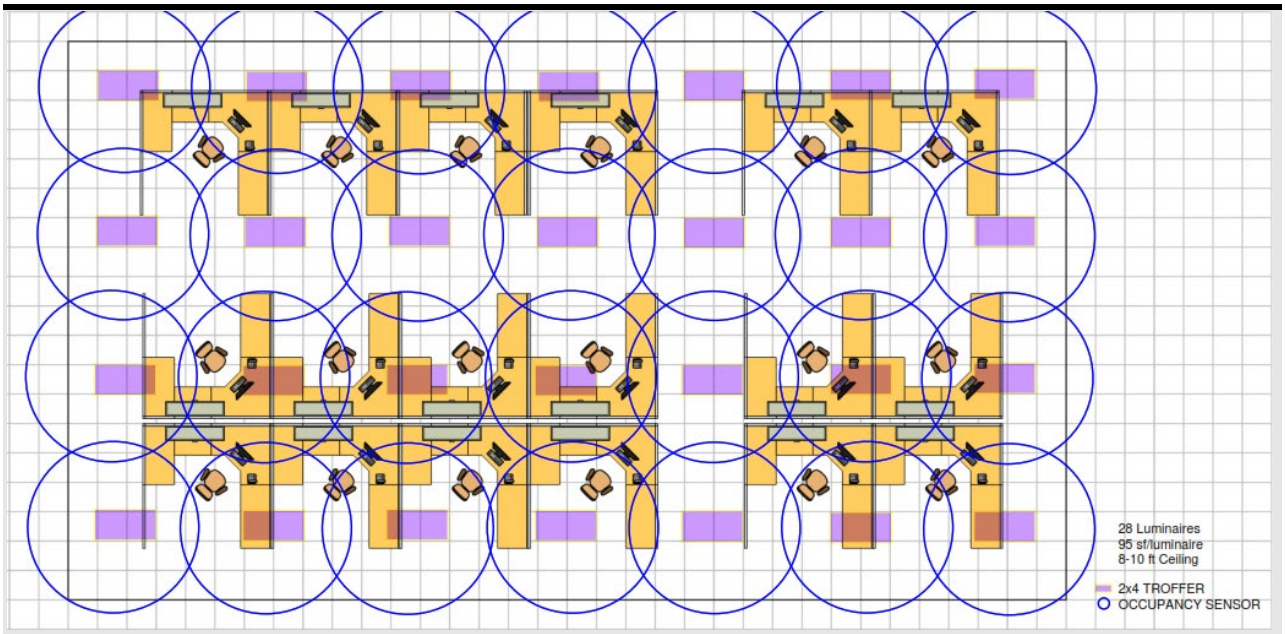


Image Source: Energy Solutions

Example 5-9: 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. The figure 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 5-13 (for Example 5-9) An Office Plan With Occupant Sensing Control Zone Layout

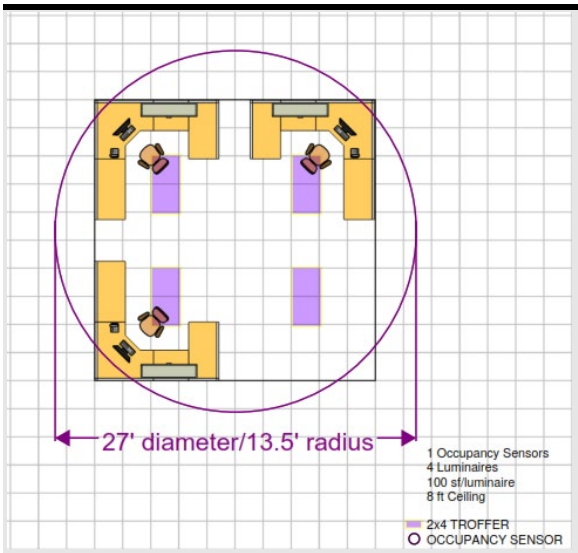


Image Source: Energy Solutions

Notes About Occupant Sensing Ventilation Controls And Occupant Sensing Lighting Controls

Note 1: Occupant sensing ventilation controls are required in spaces meeting, or 7. Occupant sensing ventilation controls for offices greater than 250 sq. ft. are now required because this space type meets both criteria. Because of this, occupant sensing zone controls for the space-conditioning system are also required. Refer to §120.1(d)5 and §120.2(e)3 in the Energy Code as well as Sections 4.3.1.1.1.37 and 4.5.1.1.1.8 of this manual to ensure occupant sensor ventilation controls and occupant sensing zone controls are properly implemented on the mechanical systems. Corridors are another space type covered by §130.1(c)6, where ventilation air is allowed to go to zero during occupied standby mode, and thus are required to meet occupant sensing ventilation control requirements.

Note 2: This occupant sensing controls requirement in §130.1(c)6D does not negate other lighting controls provisions in §130.1. For example, for office spaces greater than 250 sq. ft. where automatic daylighting controls are also required per §130.1(d), lighting in the occupied occupant sensing control zones shall be dimmed in response to the available daylight. Refer to §130.1(f) in the Energy Code and Section 5.4.6 of this manual to ensure the proper interactions among the required lighting controls.

5.4.3.6 Areas Where Partial-Off Occupant Sensing Controls Are Required Instead of Complying With §130.1(c)1

§130.1(c)7

In stairwells and common area corridors to guest rooms of hotel/motels, in parking garages and parking areas, and in loading and unloading areas, lighting is required to have partial off occupant sensing controls instead of meeting the shut off requirements of §130.1(c)1.

Lighting in these spaces may operate full time at the minimum setback level and is not required to be shut off after hours. The decision to turn the lights off fully may be made by the designer.

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

   This permits the lights to remain on at a setback level continuously. The zoning of the controls requires careful consideration of paths of egress to ensure that sensor coverage in the zone is adequate.

   EXCEPTION: In common area corridors and stairwells in which the installed lighting power is 80 percent or less of the value allowed under the Area Category Method, occupant sensing controls shall reduce power by at least 40 percent (instead of the normally required 50 percent).

B. In parking garages, parking areas, and loading and unloading areas, general lighting shall meet the following requirements:

   1. Be controlled by occupant sensing controls having at least one control step between 20 percent and 50 percent of design lighting power.
   2. No more than 500 watts of rated lighting power shall be controlled together as a single zone.
   3. A reasonably uniform level of illuminance shall be achieved in accordance with the applicable requirements in Table 5-1 (Table 130.1-A of the Energy Code).
   4. Occupant sensing controls shall be capable of automatically turning the lighting fully on only in each separately controlled space.
   5. The occupant sensing controls shall be automatically activated from all designed paths of egress.

For these spaces, 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.

EXCEPTION: Metal halide luminaires meeting both of the following criteria shall be controlled by occupant sensing controls having at least one control step between 20 percent and 60 percent of design lighting power:

- A "lamp plus ballast" means system efficacy greater than 75 lumens per watt. (The lamp plus ballast mean system efficacy is the rated mean lamp lumens at 40 percent of lamp life[1] divided by the ballast rated input watts.)
- When metal halide is used for general lighting in parking garages, parking areas, and loading and unloading areas.

The requirement for metal halide luminaires to have a control step between 20 percent and 60 percent is a limitation of the dimming or bilevel ballast technology in HID light sources.

Interior areas of parking garages are classified as indoor lighting for compliance with §130.1(c)7B.

The parking areas on the roof of a parking structure are classified as outdoor hardscape and shall comply with the applicable provisions in §130.2. Controls requirements in §130.1(c)7B do not apply to open rooftop parking.

5.4.4 Automatic Daylighting Controls

§130.1(d)

Daylighting can be used as an effective strategy to reduce electric lighting energy use by reducing electric lighting power in response to available daylight. Section 130.1(d) addresses mandatory requirements for automatic daylighting controls.

Automatic daylighting controls are required in daylit zones to automatically reduce general lighting when sufficient daylight is available.

5.4.4.1 Daylit Zones and Controlling Lighting in Daylit Zones

Terms:

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.

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

1 Illuminating Engineering Society. Section 13.3 "Life and Lumen Maintenance" in *The Lighting Handbook: 10th Edition Reference and Application*. 2011. New York.

window, minus any area on a plan beyond a permanent obstruction that is 6 feet or taller as measured from the floor.

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.

Skylit Daylit Zone (see below).

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

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

A. 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 5-14: Example of Skylit Daylit Zone Layout in Overhead View

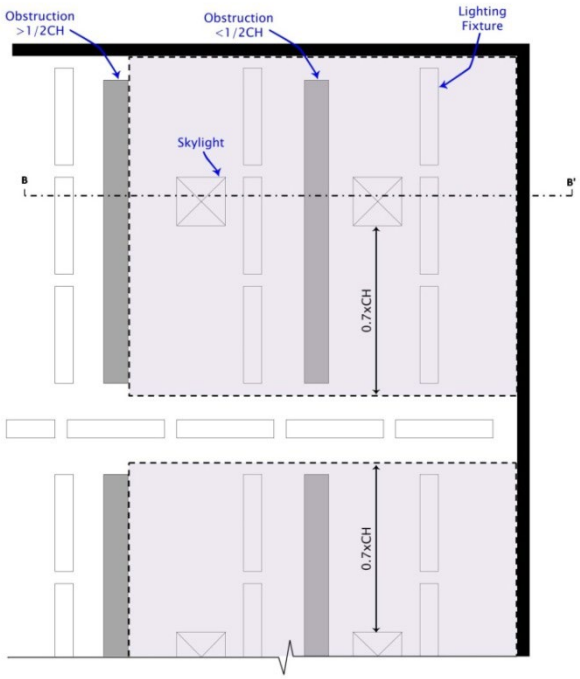


Image Source: California Energy Commission

Figure 5-15: Example of Skylit Daylit Zone Layout in Side View

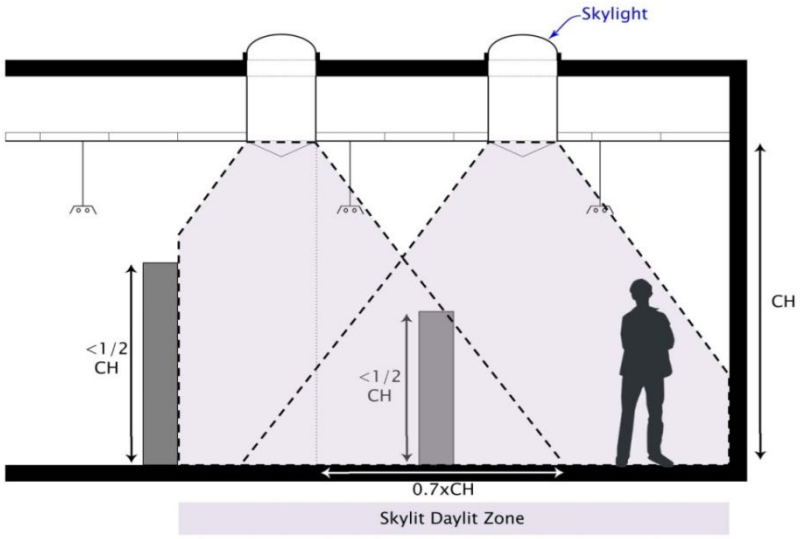


Image Source: California Energy Commission

B. 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 5-16: Example of Primary Sidelit Daylit Zone Layout in Overhead View

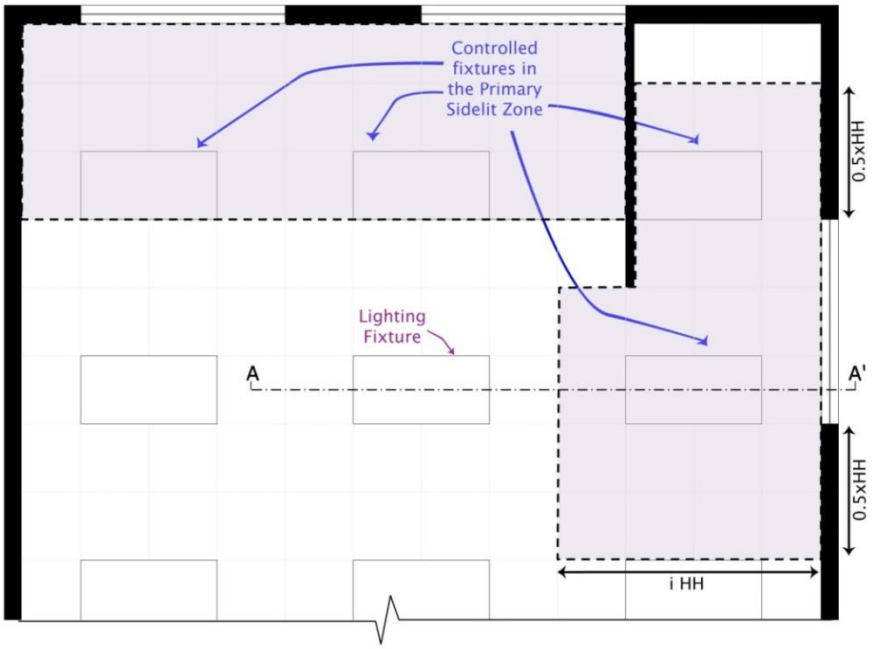


Image Source: California Energy Commission

Figure 5-17: Example of Primary Sidelit Daylit Zone Layout in Side View

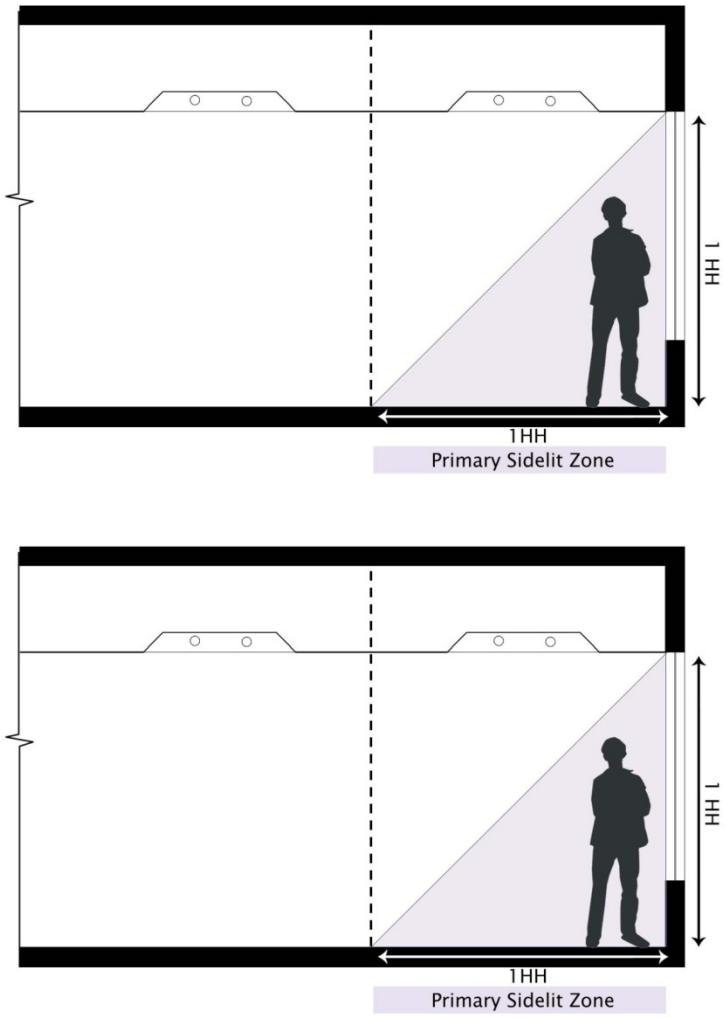


Image Source: California Energy Commission

C. 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 5-18: Example of Secondary Sidelit Daylit Zone in Side View

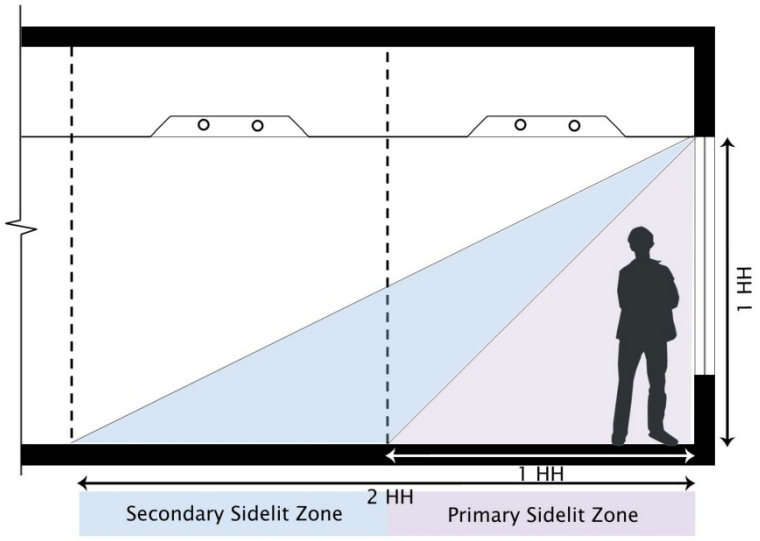


Image Source: California Energy Commission

Figure 5-19: Example of Secondary Sidelit Daylit Zone in Overhead View

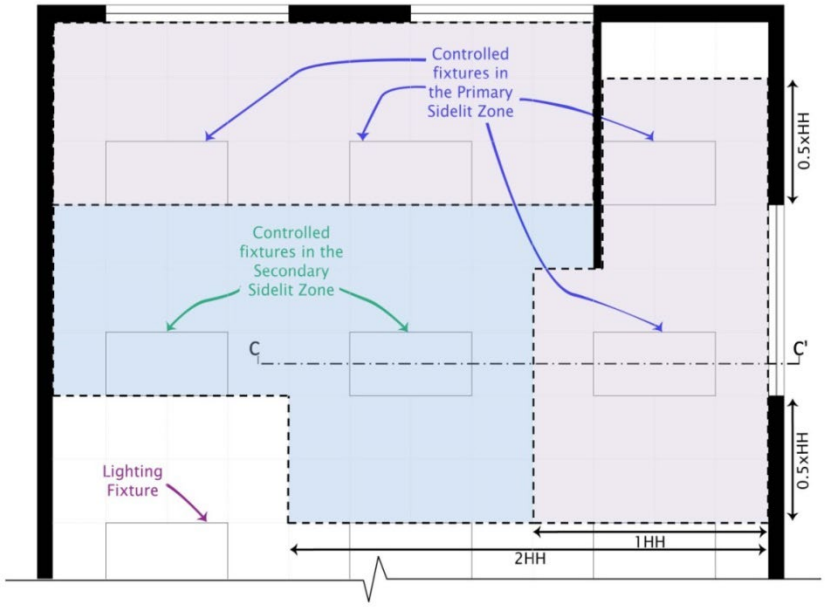


Image Source: California Energy Commission

5.4.4.2 Automatic Daylighting Controls in and for Daylit Zones

Automatic daylighting controls are required for general lighting in skylit daylit zones, primary sidelit daylit zones, and secondary sidelit daylit zones.

The requirements are as follows:

A. Luminaires providing general lighting that are at least 50 percent in the skylit daylit zone, primary sidelit daylit zone, or secondary sidelit daylit zone shall be controlled independently by automatic daylighting controls that meet the applicable requirements:

1. All skylit daylit zones, primary sidelit daylit zones, and secondary sidelit daylit zones must be shown on the building plans.
2. The automatic daylighting controls shall provide separate control for general lighting in each type of daylit zone. General lighting luminaires in the skylit daylit zone must be controlled separately from those in the primary sidelit daylit zone and secondary sidelit daylit zone.

   In spaces where skylights are near exterior walls with windows, the skylit daylit zone may overlap with either the primary or secondary sidelit daylit zone. The skylit daylit zone takes precedence, and the general lighting luminaires in the overlapping area must be controlled as part of the skylit daylit zone.
3. Where the primary sidelit daylit zone and the secondary sidelit daylit zone overlap, such as in corner spaces, the primary sidelit daylit zone takes precedence and the general lighting luminaires in the overlapping area must be controlled as part of the primary sidelit daylit zone.
4. General lighting luminaires that are long such as linear pendants, strip lights, tape lights, and cover lights shall be segmented into control sections so that lighting is controlled separately in skylit daylit zones, primary sidelit daylit zones, secondary sidelit daylit zones, and nondaylit zones. Each segment must be 4 feet or shorter and be separately controlled according to the type of daylit zone in which the segment is primarily located.

5.4.4.3 Automatic Daylighting Control Installations and Operations

For luminaires in skylit daylit zones, primary sidelit daylit zones, and secondary sidelit daylit zones, automatic daylighting controls must be installed and configured according to the following requirements:

1. Automatic daylighting controls must provide multiple lighting levels with at least the number of control steps specified in Table 5-1 (Table 130.1-A of the Energy Code).

   When the requirements of §130.1(d) are triggered by the addition of skylights to an existing building and the lighting system is not recircuited, the daylighting control is not required to meet the multilevel requirements in §130.1(d). The

daylighting control may provide on/off control in accordance with §141.0(b)2 for alterations.

2. For each space, the combined illuminance from the controlled lighting and daylight shall not be less than the illuminance from controlled lighting when no daylight is available.

   In the darkest portion of the daylit zone, the control should not overdim the lights.

3. When the daylight illuminance is greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power in that daylight zone shall be reduced by a minimum of 90 percent.

   The best control would fully dim the system when daylight levels in the darkest portion of the daylit zone are at 100 percent of the illuminance from controlled lighting when no daylight is available. The 150 percent/90 percent requirement allows some tolerance for error while obtaining most of the energy savings.

4. Photosensors shall be located so they are not readily accessible to unauthorized personnel. The location where calibration adjustments are made to automatic daylighting controls shall be readily accessible to authorized personnel and may be inside a locked case or under a cover that requires a tool for access. Access to controls can be limited by placing locks or screws on enclosures or under a cover plate so a tool or key is needed to gain access. Though not required, commissioning and retrocommissioning of the control are simplified if the calibration adjustments are readily accessible to authorized personnel so that a lift or a ladder is not required to access the location where calibration adjustment are made.

   Some controls have wireless remotes for adjusting settings. This allows one person with a light meter and the wireless calibration tool to be located at the edge of the daylit zone and make the calibration adjustments without having to run back and forth between taking the measurement and making the adjustment.

   EXCEPTIONS: Automatic daylighting controls are not required for any of the following conditions:

   - 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.
   - 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.

- Rooms in which the combined total installed wattage of general lighting power in skylit daylit zones and primary sidelit daylit zone is less than 120 watts are not required to have daylighting controls for those zones.
- Rooms where the total installed wattage of general lighting power in secondary sidelit daylit zones is less than 120 watts are not required to have daylighting controls for those zones.
- Rooms that have a total glazing area of less than 24 square feet.
- Luminaires in sidelit daylit zones in retail merchandise sales and wholesale showroom areas.

Example 5-10: Complying With the 150 Percent of the Design Illuminance Daylighting Requirement

When the illuminance received from daylight is greater than 150 percent of the design illuminance (or nighttime electric lighting illuminance), the general lighting power in the daylit zone must reduce by a minimum of 90 percent.

For example, a space has 500 watts of general lighting power in the daylit zones. The design illuminance for the space is 50 foot-candles (fc). When the available daylight in the space reaches 75 fc (that is, 150 percent of 50 fc), then the power consumed by the general lighting in the daylit zones should be 50 watts or lower.

Without checking all points in the daylit zone served by controlled lighting, verifying that the requirements are met at a worst-case location far away from windows or skylights is sufficient. This location is called the "Reference Location."

Example 5-11: Daylighting Controls and Opaque Curtain Walls

Question

Are automatic daylighting controls required for daylit zones adjacent to opaque glazing in curtain walls per §130.1(d) and §140.6(a)?

Answer

No. The automatic daylighting control requirements do not apply to daylit zones adjacent to opaque curtain walls. The Energy Code defines sidelit daylit zones as the areas in plan view directly adjacent to each vertical glazing. Glazing is a fenestration product that is defined as being transparent or translucent. Note: Automatic daylighting control requirements will apply to daylit zones adjacent to transparent or translucent curtain walls.

Example 5-12: Sidelit Daylit Zone for a Recessed Window

Question

Are sidelit daylit zones determined differently for an area adjacent to a window that is recessed in a bay?

Answer

No. The sidelit daylit zones will be determined the same way as for a window that is not recessed. The primary sidelit daylit zone extends out one window head height deep into the space and one-half a window head height to each side of the rough opening of the window. The only difference is that the sidelit daylit zone of a recessed window will be reduced by the incursion of the bay and exterior walls into the sidelit daylit zone, as shown in the following figure.

Figure 5-20: (Example 5-12) Sidelit Daylit Zone Layout for a Bay Window

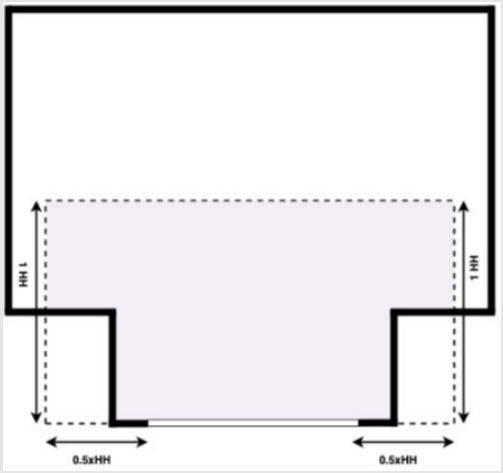


Image Source: California Energy Commission

5.4.4.4 Automatic Daylighting Controls in and for Parking Garages

In a parking garage area having a combined total of 36 square feet or more of glazing or opening, luminaires providing general lighting that are in the combined primary and secondary sidelit daylit zones shall be controlled independently from other lighting in the parking garage by automatic daylighting controls.

Parking areas on the roof of a parking structure are outdoor hardscape and automatic daylighting control requirements do not apply to these spaces.

The primary differences between the automatic daylight control requirements in parking garages and the rest of interior lighting spaces are the following:

- The primary and secondary sidelit daylit zones are controlled together in parking garages, whereas they must be separately controlled in other

spaces. However, it is permissible that in either space type, a single sensor can be used if the control system can make the appropriate light level adjustments in each zone.

- In parking garages, when the daylight illuminance is 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 zone shall be reduced by 100 percent. (In other interior spaces, the lighting power must be reduced by 90 percent.) Egress lighting for the parking garage may be controlled, but the controls must employ a fail-safe mechanism that ensures that the egress lighting is functioning and stays on if the photocell fails.

Exceptions: Automatic daylighting controls are not required in the following parking garage areas:

- Parking garage areas where the total installed wattage of general lighting in the primary and secondary sidelit daylit zones is less than 60 watts
- Parking garage areas with a total glazing or opening area less than 36 square feet
- Luminaires in the daylight adaptation zone

5.4.5 Demand-Responsive Lighting Controls

§130.1(e); §110.12

Buildings with nonresidential lighting systems having a total installed lighting power of 4,000 watts or greater that are subject to the multilevel requirements in §130.1(b) must meet demand-responsive lighting control requirements.

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 Table 130.1-A

EXCEPTION: Spaces where a health or life safety statute, ordinance, or regulation does not permit the general lighting to be reduced are exempted from the requirement and do not count toward the 4,000 watt threshold.

See Appendix D for guidance on compliance with the demand-responsive control requirements.

Example 5-13: Demand-Responsive Lighting Controls 15 Percent Reduction in Lighting Power

Question

What lighting counts toward the 4,000 watt demand-responsive lighting threshold? If this threshold is exceeded, what lighting must have demand-responsive lighting controls? What lighting counts toward the 15 percent minimum reduction?

Answer

Only general lighting that is subject to multilevel requirements in §130.1(b) counts toward the 4,000 watt threshold. When this threshold is exceeded, demand-responsive controls are required for general lighting.

The demand-responsive controls must be capable of reducing the total lighting power by a minimum of 15 percent. This includes general lighting and any additional lighting such as task, display, or other lighting. For example, consider an office that has 5,000 total installed watts of general lighting subject to §130.1(b) and 2,000 watts of additional lighting power. While only the 5,000 watts of general lighting are required to have demand response controls per §110.12(c), the 15 percent reduction is based on the 7,000 total installed watts in the office.

5.4.6 Lighting Control Interactions — Considerations for Spaces With Multiple Lighting Control Types

§130.1(f)

Indoor lighting systems subject to §130.1 require multiple types of lighting controls. Section 130.1(f) includes the requirements for control interactions between manual area controls, multilevel controls, shut off controls, daylighting controls, and demand-responsive controls.

Example 5-14: Interaction Between Manual Dimming and Automatic Daylighting Controls

Question

For a space with manual dimming control and automatic daylighting controls, can the manual dimming control override the automatic daylighting control?

Answer

Yes. Section 130.1(f) includes requirements for control interactions between lighting control types.

The automatic daylighting control must allow the multilevel lighting control to adjust the level of lighting. This means an occupant can use the dimming control to increase or decrease the lighting level as necessary and override the automatic daylighting control.

Additionally, the multilevel lighting control must allow the automatic daylighting control to adjust the electric lighting level in response to changes in the amount of daylight in the daylit zone.

5.4.6.1 Practical Considerations

For a space with both daylighting controls and dimming controls, the daylighting controls are likely to be the primary control most of the time. When the building user/occupant wants to use the dimming control to adjust the light level, they should be able to do so. The user should be able to manually override the level of light provided by the lighting system with manual dimming and a scene feature

(switching the lighting in the zone to the predefined level) according to the needs of the activity.

One method to achieve this would be for the occupant use the dimmer control to lower or raise the upper bound on the amount of light provided by the electric lighting. The dimming control would temporarily set a total lighting level that the daylighting control could then achieve by balancing the amount of electric lighting with the daylighting available in the space. This method allows the occupant to receive the benefits of both controls, rather than one control locking out the use of the other. When the activity is over, the lighting system should be restored to automatic control operation.

There is another method for spaces with all three control types — dimming, shut off, and daylighting. If the occupant sensing control is the shut off control, the lighting should restore to automatic control mode. (The occupant sensing control is triggered within 20 minutes after the area has been vacated.) If there are no occupant sensing controls and if an override is initiated, the automatic control should be overridden for no more than 20 minutes. After that, the automatic control resumes, and the light level should be set by the daylighting controls.

5.4.7 Lighting Control Functionality

§110.9(b)

All installed lighting control devices and systems must meet the functionality requirements in §110.9(b). In addition, all components of a lighting control system installed together must meet the applicable requirements in §130.0 through §130.5, §140.6 through §140.8, §141.0, and §150.0(k).

To ensure compliance with the requirements of §110.9(b), designers and installers should review features of their specified lighting control products as part of code compliance.

A. Time-Switch Lighting Controls

Time-switch lighting control products shall provide the functionality listed in §110.9(b)1.

B. Daylighting Controls

Daylighting control products shall provide the functionality listed in §110.9(b)2.

C. Dimmers

Dimmer products shall provide the functionality listed in §110.9(b)3.

D. Occupant Sensing Controls

Occupant sensing control products (including occupant sensors, partial-on occupant sensors, partial-off occupant sensors, motion sensors, and vacancy sensor controls) shall provide the functionality listed in §110.9(b)4 and §110.9(b)6.

Occupant sensing controls must be capable of automatically reducing the lighting or turning the lighting off within 20 minutes after the area has been vacated.

5.4.8 Track Lighting Integral Current Limiters and Track Lighting Supplementary Overcurrent Protection Panels

§110.9(c) and (d)

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.

Track lighting integral current limiters must meet the requirements in §110.9(c):

1. Have the volt-ampere (VA) rating clearly marked as follows:
    - So that it is visible for the local enforcement agency's field inspection without opening cover plates, fixtures, or panels.
    - Permanently marked on the circuit breaker.
    - On a factory-printed label permanently affixed to a nonremovable baseplate inside the wiring compartment.
2. 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.
3. Have a factory installed, prominently located label containing the text in §110.9(c)3.

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 and shall meet the requirements specified in §110.9(d) and paraphrased below:

1. Be listed as defined in §100.1
2. Have a factory-installed, prominently located label containing the text in §110.9(d)2

5.5 Prescriptive Requirements for Daylighting Devices and for Large Enclosed Spaces

The following are the prescriptive requirements for daylighting devices (clerestories, horizontal slats, and light shelves) that qualify for PAFs and for daylighting in large, enclosed spaces.

5.5.1 Daylighting Device (Clerestories, Horizontal Slat, and Light Shelves) Power Adjustment Factors

§140.6(a)2L

Certain design features and technologies can increase the daylighting potential of spaces. Some of these design features and technologies may be used in conjunction with automatic daylighting controls to receive PAFs from Table 140.6-A or as a performance compliance option in the performance method.

A careful analysis should be performed to avoid glare when including daylighting devices in a design. For example, specularly reflective (e.g., polished or mirror-finished) slats may redirect sunlight and cause uncomfortable glare. Since that is not the only consideration to make when considering daylighting design features, a careful daylighting analysis should be performed on a space-by-space, project-by-project basis.

The daylight dimming plus off PAF and institutional tuning in daylit areas may be added to any of the daylighting design PAFs to create a combined total PAF.

In addition, the horizontal slat PAF can be added to the clerestory fenestration PAF if the requirements for both are met.

In the performance method, a variety of control strategies is available in the compliance software to take advantage of further savings.

At permit application, use form NRCC-LTI-E to document daylighting device PAFs.

5.5.2 Daylighting Requirements for Large, Enclosed Spaces

§140.3(c)

Section 140.3 has prescriptive requirements for building envelopes, including daylighting for large, enclosed spaces directly under roofs. Lighting installed in these spaces is required to comply with all lighting control requirements, including the automatic daylighting control requirements. Mandatory daylighting control requirements are covered in Section 5.4.4 of this chapter.

For projects that comply with the prescriptive daylighting requirements by installing daylight openings in large, enclosed spaces directly under roofs, the daylit areas may require automatic daylighting controls. However, for projects using the performance approach, it is possible to displace the daylighting openings and daylighting controls with other building efficiency options

5.5.2.1 Large, Enclosed Spaces Requiring Daylighting — Qualifying Criteria

The prescriptive daylighting requirements for large, enclosed spaces apply to both conditioned and unconditioned nonresidential spaces that meet the following qualifying criteria:

1. Directly under a roof.
2. Located in Climate Zones 2 through 15.
3. Have a floor area greater than 5,000 sq ft.
4. Have a ceiling height greater than 15 ft.

   EXCEPTIONS:

   1. Auditoriums, churches, movie theaters, museums, and refrigerated warehouses.
   2. Enclosed spaces having a designed general lighting system with a lighting power density less than 0.5 W/ft^2.
   3. In buildings with unfinished interiors, future enclosed spaces in which there are plans to have one of the following:
      a. A floor area of less than or equal to 5,000 sq. ft.
      b. Ceiling heights less than or equal to 15 feet. This exception shall not be used for S-1 or S-2 (storage) or F-1 or F-2 (factory) occupancies.
   4. Enclosed spaces where it is documented that permanent architectural features of the building, existing structures, or natural objects block direct beam sunlight on at least half of the roof over the enclosed space for more than 1,500 hours per year between 8 a.m. and 4 p.m.

5.5.2.2 Prescriptive Daylighting Requirements

In Climate Zones 2 through 15, enclosed spaces larger than 5,000 sq. ft. shall have at least 75 percent of the floor area within the primary sidelit daylit zone or skylit daylit zone.

Enclosed spaces that are required to comply must meet the following prescriptive daylighting requirements:

1. A combined total of at least 75 percent of the floor area, as shown on the plans, shall be within the skylit daylit zone or primary sidelit daylit zone. The calculation of the daylit zone area to show compliance with this minimum daylighting requirement does not need to account for the presence of partitions, stacks, or racks, other than those that are ceiling-height partitions. The envelope may be designed before there is any knowledge of the location of such obstructions, as is often the case for core and shell buildings. Thus,

the architectural daylit zone requirement of 75 percent of the enclosed space indicates the possibility of the architectural space being mostly daylit.

The daylit zone and controls specification in §130.1(d) describe which luminaires are controlled. The obstructing effects of tall racks, shelves, and partitions must be taken into consideration when determining the specifications. The electrical design will likely occur later than the architectural design; thus, planning for these obstructions can be built into the lighting circuiting design. With addressable luminaires, the opportunity is available to the contractor to incorporate the latest as built modifications into the daylight control grouping of luminaires according to unobstructed access to daylight.

2. The total skylight area is at least 3 percent of the total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of the rough opening of the skylights; or the product of the total skylight area and the average skylight visible transmittance is no less than 1.5 percent of the total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of the rough opening of skylights.

   The above two requirements are represented by the following equations.

$$\frac{Skylight\ Area}{Daylit\ Zone\ under\ skylights} \geq 3\ percent\ of\ total\ floor\ area \quad (Equation\ 5-1)$$

$$Skylight\ Area \times VT \geq 1.5\ percent\ \times Daylit\ Zone\ under\ skylights \quad (Equation\ 5-2)$$

Definitions of the above equation terms:

Skylight Area = Total skylight area on the roof

Daylit Zone under skylights = Total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of the rough opening of skylights

VT = Visible Transmittance

3. General lighting in daylit zones shall be controlled in accordance with §130.1(d).
4. Skylights shall have a glazing material or diffuser that has a measured haze value greater than 90 percent, tested according to ASTM D1003 or other test method approved by the CEC.

   Skylights must also meet the maximum glazing area, thermal transmittance (U-factor), solar heat gain coefficient (SHGC), and visible transmittance (VT) requirements of §140.3(a). Plastic skylights are required to have a VT of 0.64 and glass skylights are required to have a VT of 0.49. Currently, plastics are

not accompanied by low-emissivity films, which transmit light but block most of the rest of the solar spectrum. As a result, there is no maximum SHGC for plastic skylights. Glass skylights are required to have a maximum SHGC of 0.25. With a maximum SHGC of 0.25 and a minimum VT of 0.49, glass skylights must use low-emissivity films or coatings that have a high light-to-solar gain ratio.

5. All skylit daylit zones and primary sidelit daylit zones shall be shown on building plans.

The total skylight area on the roof a building is prescriptively limited to a maximum of 5 percent of the gross roof area (§140.3[a]6A).

Example 5-15: Using Skylights to Meet the Daylighting Requirement for Large Enclosed Spaces

In buildings with large, enclosed spaces that must meet the minimum daylighting requirement, the core zone of many of these spaces will be daylit with skylights. Skylighting 75 percent of the floor area is achieved by evenly spacing skylights across the roof of the zone. A space can be fully skylit by having skylights spaced so that the edges of the skylights are not farther apart than 1.4 times the ceiling height. Therefore, in a space having a ceiling height of 20 feet, the space will be fully skylit if the skylights are spaced so there is no more than 28 feet of opaque ceiling between the skylights.

Example 5-16: Large, Enclosed Spaces in a Warehouse Building

Question

For a 40,000 sq. ft. warehouse with a 30-foot ceiling (roof deck) height, what is the maximum skylight spacing distance and recommended range of skylight area?

Answer

The maximum spacing of skylights that results in the space being fully skylit is

Maximum skylight spacing = 1.4 x ceiling height + skylight width

Spacing skylights closer together results in more lighting uniformity and, thus, better lighting quality (at an increased cost because more skylights are needed). However, as a first ,approximation one can space the skylights by 1.4 times the ceiling height. For this example, skylights can be spaced 1.4 x 30 feet = 42 feet. In general, the design will also be dictated by the size of roof decking materials (such as 4’ by 8’ plywood decking) and the spacing of roof purlins so the edge of the skylights line up with roof purlins. For this example, we assume that roof deck material is 4’ by 8’ and skylights are spaced 40 feet on center.

Each skylight is serving a 40-foot by 40-foot area of 1,600 sq. ft. A standard skylight size for warehouses is often 4’ by 8’ (displacing one piece of roof decking). The ratio of skylight area to daylit area is 2 percent (32/1,600 = 0.02). Assuming this is a plastic skylight with a VT of 0.65, the product of skylight transmittance and skylight area to daylit area ratio is (0.65)(32/1,600) = 0.013 = 1.3 percent. An 8 ft. by 8 ft. skylight (two 4 ft. by 8 ft. skylights) installed on a 40-foot spacing would yield a 2.6 percent product of skylight transmittance and skylight area to daylit area ratio. With 64 square feet of skylight area for each 1,600 square feet of roof area, the skylight to roof area ratio is 4 percent, which is less than the maximum of 5 percent allowed by §140.3(a).

An alternate approach would be to space 4 ft. by 8 ft. skylights closer together, which would provide more uniform daylight distribution in the space and produce closer to the desired minimum VT skylight area product. Taking the product of the skylight VT and the skylight area and dividing by 0.02 (the desired ratio) yields the approximate area the skylight should serve. In this case, with a VT of 0.65 and a skylight area of 32 square feet, each skylight should serve around (0.65*32 /0.02) = 1,040 square feet. A 32-foot center to center spacing of skylights results in 32 x 32 = 1,024 square feet of daylit area per skylight.

For a 4 ft. by 8 ft. plastic skylight with a visible light transmittance of 0.65, the product of skylight transmittance and skylight area to daylit area ratio is

(0.65) x (32/1,024) = 0.0203 = 2.03 percent.

5.6 Prescriptive Compliance Approach for Indoor Lighting – Introduction

5.6.1 Requirements for a Compliant Building

A building complies with §140.6 if:

1. The adjusted indoor lighting power of all proposed building areas combined, when calculated in accordance with §140.6(a), is no greater than the allowed indoor lighting power, calculated in accordance with §140.6(c).
2. The calculation of allowed indoor lighting power meets the requirements in §140.6(b).

5.6.2 Calculation of Adjusted Indoor Lighting Power

The adjusted indoor lighting power of all building areas is the total watts of all planned permanent and portable lighting systems in the proposed building.

Some adjustments are available to reduce the reported indoor lighting power. These adjustments are discussed below.

A. Power Adjustment Factors or Reduction of Wattage Through Controls

The Energy Code provides an option for a lighting power reduction credit when specific lighting controls are installed, provided those lighting controls are not 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.

In calculating adjusted indoor lighting power, the installed watts of a luminaire providing general lighting in a functional area listed in Table 140.6-C may be reduced by multiplying the watts controlled by the applicable power adjustment PAF, per Table 140.6-A.

To qualify for a PAF, the following conditions must be met:

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 a PAF will be allowed for compliance with §140.6. If any of the requirements in this Certificate of Installation are not met, the installation shall not be eligible to use the PAF.
2. Luminaires and controls meet the applicable requirements of §110.9, and §130.0 through §130.5.
3. The controlled lighting is permanently installed general lighting systems and the controls are permanently installed nonresidential-rated lighting controls (portable lighting, portable lighting controls, and residential rated lighting controls do not qualify for PAFs).

   When used for determining PAFs for general lighting in offices, furniture-mounted luminaires shall qualify as permanently installed general lighting systems if:

   a. They are installed no later than the time of building permit inspection.
   b. They are permanently hardwired.
   c. They are designed to provide indirect general lighting. (They may also have elements that provide direct task lighting.)
   d. The lighting control for the furniture mounted luminaire complies with all other applicable requirements in §140.6(a)2.

   Before multiplying the installed watts of the furniture-mounted luminaire by the applicable PAF, 2 watts per square foot of the area illuminated by the furniture mounted luminaires shall be subtracted from installed watts of the furniture mounted luminaires to account for portable lighting.

4. At least 50 percent of the light output of the controlled luminaire is within the applicable area listed in Table 140.6-A. Luminaires on lighting tracks must be within the applicable area to qualify for a PAF.
5. Only one PAF from Table 140.6-A may be used for each qualifying luminaire. PAFs shall not be added together unless specifically allowed in Table 140.6-A.
6. Only lighting wattage directly controlled in accordance with §140.6(a)2 shall be used to reduce the calculated adjusted indoor lighting power as allowed by §140.6(a)2. If only a portion of the wattage in a luminaire is controlled in accordance with §140.6(a)2, then only that portion of controlled wattage may be reduced in calculating adjusted indoor lighting power.
7. Lighting controls used to qualify for a PAF shall be designed and installed in addition to manual, multilevel, and automatic lighting controls required in §130.1, and in addition to any other lighting controls required by the Energy Code.
8. To qualify for the PAF for daylight continuous dimming plus off control, the following requirements must be met:
    a. The daylight control and controlled luminaires must meet the requirements of §130.1(d), 130.4(a)3, and 130.4(a)7.
    b. The daylight control 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.
    c. The PAF shall apply to the luminaires in the primary sidelit daylit zone, secondary sidelit daylit zone, and skylit daylit zone.
9. To qualify for the PAF for an occupant sensing control controlling the general lighting in large office areas above workstations, in accordance with Table 140.6-A, each occupant sensing control zone must be 250 square feet or smaller and the following requirements must be met (note that occupant sensing controls are already required in offices greater than 250 square feet per §130.1(c)6D, and each occupant sensing control zone may not be greater than 600 square feet (refer to Section 5.4.3 for more information); This PAF is provided when the occupant sensing control zones are 250 square feet or smaller):
    a. The office area must be greater than 250 square feet.
    b. This PAF is available only in office areas with workstations.
    c. Controlled luminaires may only be those that provide general lighting directly above the controlled area or furniture-mounted luminaires that comply with §140.6(a)2 and provide general lighting directly above the controlled area.
    d. Qualifying luminaires must be controlled by occupant sensing controls that meet the following requirements, as applicable:

i. Infrared sensors shall be equipped (either by the manufacturer or in the field by the installer) with lenses or shrouds to prevent them from being triggered by movement outside the controlled area.

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

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

e. The PAF shall be applied only to the portion of the installed lighting power that is controlled by the occupant sensors, not to the total installed lighting power.

f. The value of the PAF (0.2 or 0.3) depends on the square footage controlled by each occupant sensor.

10. The following requirements must be met to qualify for the institutional tuning PAF:

a. The lighting controls must 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.

b. The means of setting the limit must be accessible only to authorized personnel.

c. The setting of the limit must be verified by the acceptance test required by §130.4(a)7.

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

11. To qualify for the Demand Responsive Control PAF, the general lighting wattage receiving the PAF must not be within the scope of §110.12(c) and the following requirements must be met:

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

b. General lighting must be reduced in a manner consistent with the uniform level of illumination requirements in Table 130.1-A.

Requirements of §110.12(c): Buildings with nonresidential lighting systems having a total installed lighting power of 4,000 watts or greater that is subject to the requirements of §130.1(b) shall install controls capable of automatically reducing lighting power in response to a Demand Response Signal. See Section 5.4.5 of this manual for more information.

12. To qualify for the PAF for daylighting devices (including clerestories, light shelves, and horizontal slats) in Table 140.6-A, the daylighting devices must meet the requirements in §140.3(d). The PAFs shall only apply to lighting in a

primary or secondary sidelit daylit zone where continuous dimming daylighting controls meeting the requirements of §130.1(d) are installed.

Refer to Chapter 3 for more information on the requirements for daylighting devices that qualify for a PAF.

B. Luminaire Power Adjustment

Color-tunable LED lighting technologies are available for lighting applications including hospitality, healthcare, and other uses. This technology produces correlated color temperatures (CCT) that match the current use of a space.

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 0.80 if the luminaire meet all of the requirements of §140.6(a)4B, paragraphed below:

- 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.
- 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.
- Controls: Connected to controls that allow color changing of the illumination.

Figure 5-21: Example of Dim-to-Warm Lighting: An Indoor Space With Dim-to-Warm Luminaires (top); Relationship of Dimming to Change in Correlated Color Temperature of Dim-to-Warm (aka "WarmDim") Lighting Technology (bottom image)

Image Source: NORA Lighting

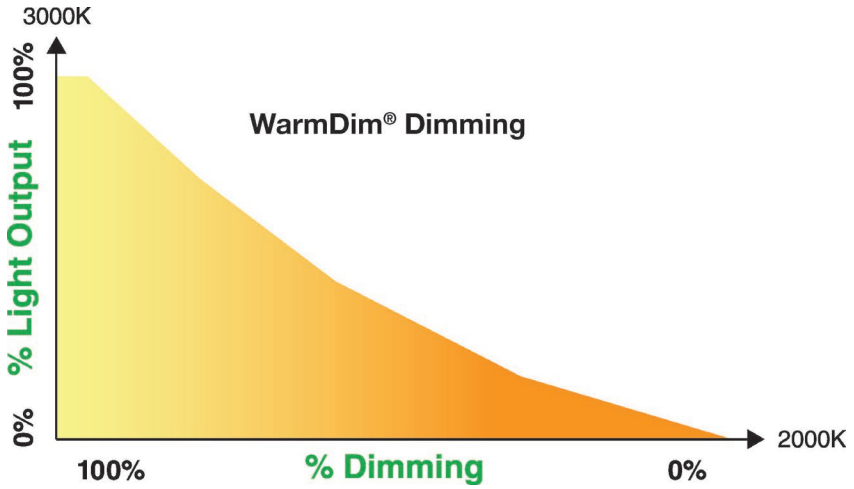


Image Source: Juno WarmDimming® Dimming courtesy of Acuity Brands Lighting, Inc.

C. Portable Lighting in Office Areas

Section 140.6(a) of the Energy Code requires that all planned lighting, including portable and permanent lighting systems, be counted toward the lighting energy use of the building, regardless of when it is planned to be installed.

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. When using the area category method for offices with portable lighting, the additional lighting power provision is available for portable lighting and decorative/display lighting. Refer to Section 5.7.3 for more information about the area category method.

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.

D. Two Interlocked Lighting Systems

Within the following five functional areas, as defined in §100.1, two lighting systems may be installed provided they are interlocked so that both lighting systems cannot operate simultaneously. All other functional areas are permitted to install only one lighting system.

1. Auditorium
2. Convention center
3. Conference room
4. Multipurpose room
5. Theater

No more than two lighting systems may be used for these five specifically defined functional areas, and if there are two lighting systems, they must be interlocked.

Where there are two interlocked lighting systems, the lower-wattage system may be excluded from determining the adjusted indoor lighting power if:

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.

E. Lighting Wattage Not Counted Toward Building Load

The Energy Code does not require the lighting power of certain types of luminaires in specific functional areas, or for specific purposes, to be counted toward the installed lighting power of a building. For example, lighting in the guest rooms of hotels is not required to be counted for compliance with §140.6. However, lighting in all other function areas within a hotel are required to comply with all applicable requirements in §140.6. Lighting in guest rooms is, however, regulated by the low-rise residential lighting standards.

The wattage of the following indoor lighting applications may be excluded from the adjusted (installed) indoor lighting power:

- Lighting for themes and special effects in theme parks.
- Studio lighting for film or photography provided that these lighting systems are in addition to and separately switched from a general lighting system.
- Lighting for dance floors, theatrical and other live performances, and religious worship provided that these lighting systems are in addition to a general lighting system and are separately controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.
- Lighting intended for makeup, hair, and costume preparation in performance arts facility dressing rooms if the lighting is switched separately from the general lighting system, switched independently at each dressing station, and controlled with a vacancy sensor.

- Lighting for temporary exhibits in civic facilities, transportation facilities, convention centers, and hotel function areas if the lighting is an addition to a general lighting system and is separately controlled from a panel accessible only to authorized operators.
- Lighting installed by the manufacturer in walk-in freezers, vending machines, food preparation equipment, and scientific and industrial equipment.
- Examination and surgical lights, low-ambient night-lights, and lighting integral to medical equipment, if this lighting is in addition to and switched separately from a general lighting system.
- Lighting for plant growth or maintenance in non-controlled environment horticulture spaces, if it is controlled by a multilevel astronomical time-switch control that complies with the applicable provisions of §110.9.
- Lighting equipment that is for sale.
- Lighting demonstration equipment in lighting education facilities.
- Lighting that is required for exit signs subject to the CBC. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.
- Exit way or egress illumination that is normally off and that is subject to the CBC.
- In hotel/motel buildings: Lighting in guest rooms (lighting in hotel/motel guest rooms must comply with §130.0(b). (Indoor lighting not in guest rooms must be in compliance with all applicable nonresidential lighting requirements in the Energy Code.)
- Temporary lighting systems. Temporary lighting is defined as a lighting installation with plug-in connections that does not persist beyond 60 consecutive days or more than 120 days per year.
- Lighting in Occupancy Group U buildings smaller than 1,000 sq. ft.
- Lighting in unconditioned agricultural buildings smaller than 2,500 sq. ft.
- Lighting systems in qualified historic buildings, as defined in the State Historic Building Code (Title 24, Part 8), are exempt from the lighting power 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 replica components are exempt. All other lighting systems in qualified historic buildings shall comply with the lighting power allowances.
- Lighting in nonresidential parking garages for seven or fewer vehicles must comply with the applicable residential parking garage provisions of §150.0(k).
- Lighting for signs must comply with §140.8.

- Lighting in refrigerated cases smaller than 3,000 sq ft. must comply with the Appliance Efficiency Regulations.
- Lighting in elevators meeting the requirements in §120.6(f).
- Lighting connected to a life safety branch or critical branch, as specified in Section 517 of the California Electrical Code.
- Horticultural lighting in Controlled Environment Horticulture (CEH) spaces (indoor growing and greenhouses) complying with Section 120.6(h).

Nonresidential indoor lighting applications not listed above must comply with all applicable nonresidential indoor lighting requirements.

Example 5-17: Lighting Power Exceptions and Control Requirements

Question

For indoor lighting, if lighting is excluded from the indoor power limitations per §140.6(a)3, is that lighting also excluded from the indoor lighting control requirements of §130.1?

Answer

No. Indoor lighting excluded from the power limitations of §140.6 is not necessarily exempt from the mandatory control requirements of §130.1. These sections are independent of each other.

5.7 Prescriptive Compliance Approach for Indoor Lighting — Allowed Indoor Lighting Power

5.7.1 General Rules for Calculation of Allowed Indoor Lighting Power

§140.6(b)

The Energy Code limits the amount of lighting power that may be installed in a building. The following are the general rules for calculating allowed indoor lighting power.

1. There shall be no lighting power allotment trade-offs between the separate conditioned and unconditioned indoor function areas. Indoor conditioned and indoor unconditioned lighting power allotments must each be separately determined on compliance documentation.
2. There shall be no lighting power allotment trade-offs between the separate indoor and outdoor function areas. Indoor and outdoor lighting power allotments must each be separately determined on compliance documentation.
3. Some areas of a building may use the Tailored Method, while other areas of the same building may use the Area Category Method. However, no single area

in a building shall be allowed to use both the Tailored Method and the Area Category Method.

4. The Tailored Method shall not be used in any building using the Complete Building method for compliance.

5.7.2 Complete Building Method (One of the Three Prescriptive Compliance Approaches)

§140.6(c)1

The Complete Building Method shall only be applied when lighting will be installed throughout the entire building. The building must consist of one type of use for a minimum of 90 percent of the floor area of the entire building.

The allowed indoor lighting power allotment for the entire building shall be calculated as follows:

1. For a conditioned building, multiply the entire conditioned floor area of the building by the applicable lighting power density (LPD, watts per sq. ft.) provided in Table 140.6-B.
2. For an unconditioned building, multiply the entire unconditioned floor area of the building by the applicable LPD provided in Table 140.6-B.

5.7.2.1 Requirements for Using the Complete Building Method

The Complete Building Method shall be used only for building types, as defined in §100.1, that are specifically listed in Table 140.6-B (for example, retail store buildings and office buildings.)

The Complete Building Method shall be used only on projects involving:

a. Entire buildings with one type of use occupancy.
b. Mixed occupancy buildings where one type of use makes up at least 90 percent of the entire building (in which case, when applying the Complete Building Method, it shall be assumed that the primary use is 100 percent of the building).
c. A tenant space where one type of use makes up at least 90 percent of the entire tenant space (in which case, when applying the Complete Building Method, it shall be assumed that the primary use is 100 percent of the tenant space).

A few more notes as follows:

- Use the Complete Building Method only when the applicant is applying for a lighting permit and submits plans and specifications for the entire building or the entire tenant space.

- Use the Complete Building Method only when the lighting power allotment in Table 140.6-B is available for the entire building. There are no additional lighting power allowances available when using Complete Building Method. Also, there are no mounting height multipliers available when using the Complete Building Method.
- For buildings including a parking garage plus another type of use listed in Table 140.6-B, the parking garage portion of the building and other type of use portion of the building shall each separately use the Complete Building Method.

Example 5-18: Mixed-Occupancy Parking Garage Building

Question

A building is to be constructed with 95 percent of it consisting of a parking garage, and the remaining 5 percent consisting of offices and support spaces such as an electrical room. What is the assumed building type under the complete building method?

Answer

Since parking garage makes up at least 90 percent of the entire building, the building shall be considered a parking garage when applying the Complete Building Method.

5.7.2.2 Definitions of Complete Building Types

When using the Complete Building Method, qualifying building types are those in which a minimum of 90 percent of the building floor area functions as one of the building types listed in Table 140.6-B, (as defined below), and which do not qualify as any other building occupancy type more specifically defined in §100.1 (the occupancy type information are provided below), and which do not have a combined total of more than 10 percent of the area functioning as any nonresidential function areas specifically defined in §100.1.

Definitions of Nonresidential Building Occupancy Types (Below are partial list from §100.1):

Assembly Building is a building with meeting halls in which people gather for civic, social, or recreational activities. These include civic centers, convention centers and auditoriums.

Grocery Store Building is a building with building floor areas used for the display and sale of food.

Gymnasium Building is a building with building floor areas used for physical exercises and recreational sport events and activities.

Healthcare Facility is any building or portion thereof licensed pursuant to California Health and Safety Code Division 2, Chapter 1, section 1204 or Chapter 2, section 1250.

Industrial/Manufacturing Facility Building is a building with building floor areas used for performing a craft, assembly, or manufacturing operation.

Office Building is a building of CBC Group B Occupancy with building floor areas in which business, clerical or professional activities are conducted.

Parking Garage Building is a building with building floor areas used for parking vehicles and consists of at least a roof over the parking area enclosed with walls on all sides. The building includes areas for vehicle maneuvering to reach designated parking spaces. If the roof of a parking structure is also used for parking, the section without an overhead roof is considered an outdoor parking lot instead of a parking garage.

Religious Facility Building is a building with building floor areas used for assembly of people to worship.

Restaurant Building is a building with building floor areas in which food and drink are prepared and served to customers in return for money.

Retail Store Building is a building with building floor areas used for the display and sale of merchandise except food.

School Building is a building used by an educational institution. The building floor area can include classrooms or educational laboratories, and may include an auditorium, gymnasium, kitchen, library, multipurpose room, cafeteria, student union, or workroom. A maintenance or storage building is not a school building.

5.7.3 Area Category Method (One of the Prescriptive Compliance Approaches)

§140.6(c)2

5.7.3.1 Area Category Method General Lighting Power Allotment

The Area Category Method is more flexible than the Complete Building Method because it can be used for multiple tenants or partially completed buildings. 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 140.6-C. For primary function areas not listed, selection of a reasonably equivalent type shall be permitted. When the lighting in these areas is completed later under a new permit, the applicant may show compliance with any of the lighting options except the Complete Building Method.

The Area Category Method divides a building into primary function areas. Each function area is defined in §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 function area in the building must be included as a separate area. Boundaries between primary function areas may or may not consist of walls or partitions. For example, kitchen and dining areas within a fast food restaurant 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 for an entire building however, the main entry lobbies, corridors, restrooms, and support functions shall each be treated as separate function areas.

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

1. The Area Category Method shall be used only for primary function areas, as defined in §100.1, that are listed in Table 140.6-C.
2. Primary Function Areas in Table 140.6-C shall not apply to a complete building. Each primary function area shall be determined as a separate area.
3. For purposes of compliance with §140.6(c)2, an "area" shall be defined as all contiguous areas which accommodate or are associated with a single primary function area listed in Table 146.0-C.
4. 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.
5. If at the time of permitting for a newly constructed building, a tenant is not identified for a multitenant area, a maximum of 0.4 watts per sq. ft. shall be allowed for the lighting in each area in which a tenant has not been identified. The area shall be classified as Unleased Tenant Area.
6. Under the Area Category Method, the allowed indoor lighting power for each primary function area is the lighting power density value in Table 140.6-C multiplied by the square footage of the primary function area. The total allowed indoor lighting power for the building is the sum of the allowed indoor lighting power for all areas in the building.

5.7.3.2 Additional Lighting Power — Area Category Method

In addition to the allowed indoor lighting power calculated according to §140.6-B through F, the building may add additional lighting power allowances for qualifying lighting systems as specified in the Qualifying Lighting Systems column in Table 140.6-C under the following conditions:

1. Only primary function areas having a lighting system as specified in the Qualifying Lighting Systems column in Table 140.6-C and in accordance with

the corresponding footnote of the table shall qualify for the additional lighting power allowances.

2. 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.
3. 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.
4. The additional lighting power allowances shall not utilize any type of luminaires that are used for general lighting in the building.
5. The additional lighting power allowances are used only for areas complying with the Area Category Method. The allowances shall not be used when using the Complete Building Method or when the Tailored Method is used for an area in the building.
6. The additional lighting power allowed is the smaller of:
   i. The lighting power density listed in the "Allowed Additional Lighting LPD" column in Table 140.6-C, times the sq. ft. of the primary function, or
   ii. The adjusted indoor lighting power of the applicable lighting.
7. In addition to meeting §140.6(c)2Gi through vi, additional lighting power for videoconferencing as specified in Table 140.6-C shall be allowed in a videoconferencing studio, as defined in §100.1, provided the following conditions are met:
   i. Before the Additional Videoconference Studio Lighting power allotment will be allowed for compliance with §140.6 of the Energy Code, 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 shall sign and submit the certificate of installation.

      If any of the requirements in this certificate of installation are not met, the Additional Videoconference Studio Lighting installation shall not be eligible for the additional lighting power allotment.
   ii. The Videoconferencing Studio is a room with permanently installed videoconferencing cameras, audio equipment, and playback equipment for both audio-based and video-based two-way communication between local and remote sites.
   iii. General lighting is controlled in accordance with Table 130.1-A.
   iv. Wall wash lighting is separately switched from the general lighting system.

v. All of the lighting in the studio, including general lighting and additional lighting power allowed by §140.6(c)2Gvii is controlled by a multi-scene programmable control system (also known as a scene preset control system).

Lighting Terms:

(related to both Area Category Method and Tailored Method)

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.

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.

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.

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 of artwork, which is not displayed against a wall.

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

Special Effects Lighting is lighting installed to give off luminance instead of providing illuminance, which does not serve as general, task, or display lighting.

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.

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 merchandise on a shelf or wall-mounted artwork, which is displayed on perimeter walls.

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 merchandise, goods, and artifacts, in a show window, to be viewed from the outside of a space through a window.

Example 5-19: Lighting Power Allowance for Special Effect Lighting and Non-General Lighting

There is lighting power allowance for special effects lighting in the Decorative/Special Effects Lighting additional power allowance in the tailored method to lighting power compliance in Table 140.6-D where both terms are combined.

Both the area category method (Table 140.6-C) and the tailored method (table 140.6-D) provide additional lighting power allowances for lighting that is not considered general lighting; however, to claim these allowances, the other lighting systems must be separately switched.

Under layered lighting design scenarios with multiple luminaire types, compliance documentation will require allocating some or all of non-general lighting power to the additional lighting power allowances and the rest of the lighting wattage to the general lighting power allowance. Only the general lighting power allowance is able to be shared across different spaces.

When there is only one lighting system type in a space, such as is the case when a monolithic design approach is taken, that system type will be treated as general lighting. Thus, light fixtures that might ordinarily be considered ornamental or display luminaires are considered general lighting luminaires if they are the only system type in a given enclosed space.

Example 5-20: Corridor With Accent Lighting and General Lighting

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 5-22: 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 Scone Luminaires (right image)

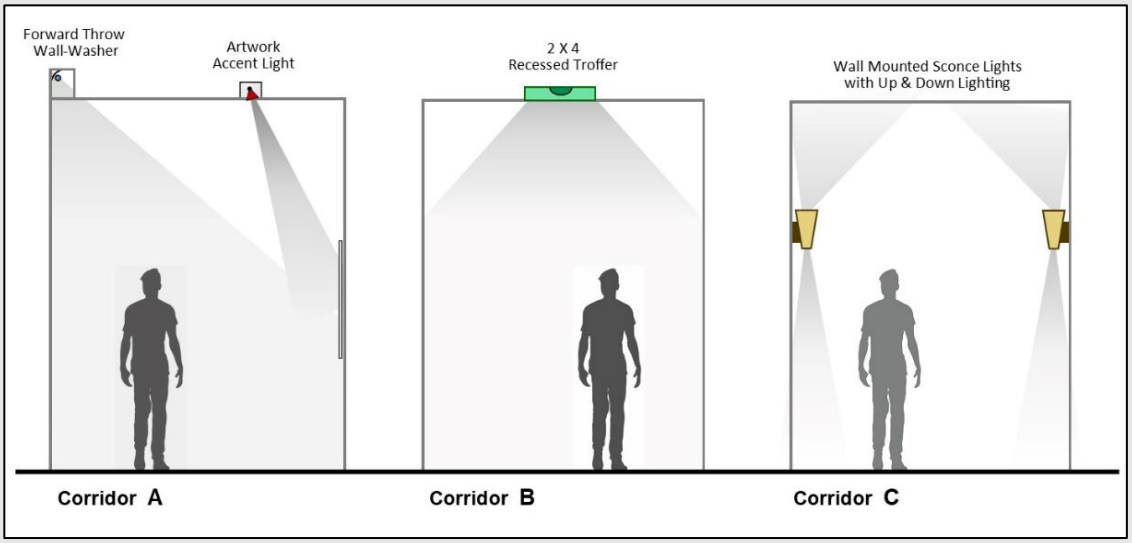


Image Source: Bernie Bauer

Corridor A has two lighting systems: forward wall-washers which provides 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 per Table 140.6-C Area Category Method are allowed up to the 0.40 W per sq. ft general lighting allowance 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 0.25 W per sq. ft. decorative/display lighting allowance listed under the "Additional Lighting Power" column of Table 140.6-C.

One option: provided the total lighting power of the wall-washers and accent lights is equal to or less than the allowed 0.4 W per sq. ft. general lighting power allowance for corridor spaces under Table 140.6-C, both luminaires may use the general lighting power allowance.

Another option: if the total lighting power of the wall-washers and accent lights exceeds the 0.4 W per sq. ft. general lighting power allowance for corridor spaces under Table 140.6-C, an additional 0.25 W per sq. ft. decorative/display lighting allowance may be used for the accent lights provided that the accent lights are separately switched from the wall washers. The additional lighting power allowed will be the lower of the calculated additional allowance for decorative/display lighting or the proposed wattage of the accent lighting.

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 0.4 W per sq. ft. general lighting power allowance for corridor spaces listed in Table 140.6-C. The 0.25 W per sq. ft. 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 are assigned the 0.40 W per sq. ft. general lighting power allowance for corridor spaces as listed in Table 140.6-C. If needed, the 0.25 W per sq. ft. 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.

Example 5-21: Calculating the Allowed Lighting Power Using Area Category Method

Question

What is the allowed lighting power for a 10,000-ft² multi-use building with the following area types?
- Main entry lobby of 500 ft²,
- Corridors of 1,500 ft²,
- Grocery store (Grocery Sales) of 3,000 ft²,
- Retail store (Retail Merchandise Sales) of 2,500 ft²
- Restrooms of 500 ft²
- Future development of 2,000 ft²

Answer

Most of the functional area types and corresponding lighting power density values can be found in Table 140.6-C. The future development area type is unknown with no built-out

plan at the time of permitting, therefore the function area type is designated as "All other" with LPD of 0.4 W/ft².

	Area	LPD	Size in ft²	Allowed Lighting Power
1)	Main Entry	0.7 W/ft²	500 ft²	350 W
2)	Corridors	0.4 W/ft²	1,500 ft²	600 W
3)	Grocery Store (Grocery Sales)	1 W/ft²	3,000 ft²	3,000 W
4)	Retail Store (Merchandise Sales)	0.95 W/ft²	2,500 ft²	2,375 W
5)	Restrooms	0.65 W/ft²	500 ft²	325 W
6)	Future Development (All other)	0.4 W/ft²	2,000 ft²	800 W
	TOTAL		10,000 ft²	7,450 watts

Example 5-22: Tunable-White and Dim-to-Warm Luminaires

Question

Which tunable-white and dim-to-warm luminaires qualify for the additional lighting power allowance for applications in healthcare facilities?

Answer

There is additional lighting power allowance for tunable-white and dim-to-warm luminaires for most of the healthcare/hospital function areas as specified in Table 140.6-C.

The qualified tunable-white luminaires shall be capable of color change ≥ 2000K CCT.

The qualified dim-to-warm luminaires shall be capable of color change ≥ 500K CCT.

A dim-to-warm luminaire product capable of color tune from 2700K to 1800K is acceptable and qualifies for the additional light power.

5.7.4 Tailored Method (One of the Prescriptive Compliance Approaches)

§140.6(c)3

5.7.4.1 Tailored Method Application

The Tailored Method is a lighting compliance approach which establishes an allowed lighting power budget on a room-by-room or area-by-area basis.

Use of tailored method could be helpful when more general lighting power is required for the listed primary function areas[2] in Table 140.6-D that have a high room cavity ratio (RCR).

In addition to providing a lighting power budget for general illumination, the tailored method provides additional lighting power budgets for illuminating wall displays, floor displays, task lighting, and decorative/special effects lighting. These additional layers of lighting power have been informally referred to as "use-it-or-lose-it" lighting power allowances because these additional allowances cannot be traded-off to other areas or applications. If a lighting design does not include these additional layers of lighting power, the total lighting power budget using the Tailored Method may be less than if the Area Category Method or Complete Building Method of compliance is used.

5.7.4.2 Determining Allowed General Lighting Power Using the Tailored Method

§140.6(c)3G thru 3H; Table 140.6-D, F, G

A. Tailored Method Trade-Off Allowances

Compliance tools such as compliance software programs can be used to document trading-off Tailored Method lighting power allotments. Trade-offs are available only for general lighting and only under the following circumstances:

1. From one conditioned primary function area using the Tailored Method, to another conditioned primary function area using the Tailored Method.
2. From one conditioned primary function area using the Tailored Method, to another conditioned primary function area using the Area Category Method.
3. From one unconditioned primary function area using the Tailored Method, to another unconditioned primary function area using the Tailored Method.
4. From one unconditioned primary function area using the Tailored Method, to another unconditioned primary function area using the Area Category Method.

A. Calculating Tailored Method General Lighting Power Allotments

The Energy Code defines general lighting as installed electric lighting that provides a uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect, exclusive of daylighting. To qualify as

2 Definitions of the primary function areas can be found in §100.1.

general lighting for the Tailored Method, the lighting system shall not use narrow beam direction lamps, wall-washers, valance, direct cove, or perimeter linear slot types of lighting systems.

Section 140.6(c)3F shall be used to determine the general lighting power density allotments as follows:

1. **Using Table 140.6-D and 140.6-G to Determine General Lighting Power Allotments:**
   a. Find the appropriate Primary Function Area in column 1 of Table 140.6-D that fits one of the Nonresidential Function Area definitions in §100.1.
   b. Find the corresponding General Illumination Level (Lux) in column 2.
   c. Determine the room cavity ratio (RCR) for that primary function area, according to the applicable equation in Table 140.6-F. Use the nonresidential certificate of compliance to document the RCR calculation.
   d. Refer to Table 140.6-G, using the General Illumination Level (Lux, determined according to item b), and the RCR (determined according to item c), to determine the allowed general lighting power density value.
   e. Multiply the allowed general lighting power density value by the square footage of the primary function area. The product is the allowed general lighting power for general lighting for that primary function area.
2. **How to calculate Room Cavity Ratio (RCR)**
   - The room cavity ratio must be determined for any primary function area using the Tailored Lighting Method.
   - The lighting level in a room is affected in part by the configuration of the room, expressed as the room cavity ratio (RCR). Rooms with relatively high ceilings typically are more difficult to light and have a high RCR. Because luminaires are not as effective in a room with a high RCR, §140.6 allows a greater LPD to compensate for this effect.
   - The RCR is based on the entire space bounded by floor-to-ceiling partitions. If a task area within a larger space is not bounded by floor to ceiling partitions, the RCR of the entire space must be used for the task area. The exception to this rule allows for imaginary or virtual walls when the boundaries are established by "high stack" elements (close to the ceiling structure and high storage shelves) or high partial walls defined as "permanent full height partitions" described in §140.6(c)3Giii wall display. These permanent full height partitions are only applicable when claiming additional lighting power for wall display lighting.
   - The RCR is calculated from one of the following formulas:

Equation 5-3 (Table 140.6-F) Rectangular Shaped Rooms

$$RCR = \frac{5 \times H \times (L + W)}{A}$$

Where:

RCR = The room cavity ratio
H = The room cavity height, vertical distance measured from the work plane to the center line of the luminaire
L = The room length using interior dimensions
W = The room width using interior dimensions
A = The room area (L x W)

Equation 5-4 (Table 140.6-F) Non-Rectangular Shaped Rooms

$$RCR = \frac{[2.5 \times H \times P]}{A}$$

Where:

RCR = The room cavity ratio
H = The room cavity height (see equation above)
A = The room area
P = The room perimeter length

- For rectangular rooms, these two methods yield the same result and the second more general form of calculating RCR may be used in all instances, if desirable.
- It is not necessary to document RCR values for rooms with an RCR less than 2.0. Rooms with a RCR higher than 2.0 are allowed higher LPDs under the Tailored Method.
- A special situation occurs when illuminating stacks of shelves in libraries, warehouses, and similar spaces. In this situation, the lighting requirements are to illuminate the vertical stack rather than the horizontal floor area. In stack areas the RCR is assumed to be greater than seven. The non-stack areas are treated normally.

Example 5-23: Calculating Room Cavity Ratio (RCR)

Question

A small retail shop "Personal Shopper" room is 14 ft. wide by 20 ft. long by 8 ft. high. The lighting system uses recessed ceiling fixtures. The task surface is at desk height (2.5 ft. above the floor). What is the room cavity ratio?

Answer

The room cavity height is the distance from the ceiling (center line of luminaires) to the task surface (desk height). This is 8 ft. -2.5 ft. = 5.5 ft.

RCR = 5 x H x (L + W) / Area

RCR = 5 x 5.5 (14+20) / (14 x 20) = 3.34

5.7.4.3 Additional Lighting Power – Tailored Method

§140.6(c)3G thru 3J; Table 140.6-D and E

When using the Tailored Method for lighting compliance, there are additional lighting power allowances for the following lighting applications:

- Wall display lighting
- Floor display lighting and task lighting
- Decorative/special effects lighting
- Very valuable display case lighting

The additional lighting power values and adjustment factor values are listed in Table 140.6-D, E, F, and G. These additional layers of lighting power are not available when using §140.6(c)3F to determine the general Lighting Power allotment and are not available for any primary function areas using the Complete Building or Area Category methods of compliance.

All of the additional lighting power allowances are "use-it-or-lose-it" allowances that cannot be traded-off. That is, if the installed watts are less than the allowed watts, the difference in watts is not available to trade off anywhere else in the building.

Use the appropriate compliance form to document the additional lighting power for wall display lighting, floor display lighting and task lighting, decorative/special effects lighting, and very valuable display case lighting.

Lighting Terms:

(related to Tailored Method and Area Category Method)

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 of artwork, which is not displayed against a wall.

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 merchandise on a shelf or wall-mounted artwork, which is displayed on perimeter walls.

Display Case Lighting is lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance of small art objects, artifacts, or valuable collections which involves customer inspection of very fine detail from outside of a glass enclosed display case.
Task Lighting is lighting directed to a specific surface or area, providing illumination for visual tasks. Task lighting is not general lighting.

B. Additional Wall Display Lighting Power

Wall display lighting is defined as supplementary lighting required to highlight features such as merchandise on a shelf or other wall features such as graphics, artwork, or product presentation; and that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance.

Additional allowed power for wall display lighting is available only for lighting that illuminates walls having wall displays or wall features, and only when there is a watt per linear foot allowance in column 3 of Table 140.6-D for the primary function area.

1. The additional allowed power for wall display lighting shall be the smaller of:
   i. The wall display lighting power density values (column 3 of Table 140.6-D) multiplied by the wall display length.
   ii. The adjusted lighting power used for the wall display luminaires.

   Calculate the adjusted lighting power by multiplying the maximum rated wattage of the wall display luminaires with the appropriate mounting height adjustment factor from Table 140.6-E.

   Note that mounting height adjustment factor is available for wall display luminaires mounted greater than 10 feet 6 inches from the finished floor. Mounting height is the distance from the finished floor to the bottom of the luminaire.
2. To qualify for the additional wall display lighting power:
   i. The lighting system shall be a type that is appropriate for creating a higher level of illuminance on the wall display. Lighting systems appropriate for wall display lighting are lighting track adjacent to the wall, wall-washer luminaires, luminaires behind a wall valance or wall cove, or accent light. (Accent luminaires are adjustable or fixed luminaires with PAR, R, MR, AR, or luminaires providing directional display lighting.)
   ii. The qualifying wall display lighting shall be mounted within 10 feet of the wall having the wall display.
   iii. The lighting system shall not be a general lighting system type.

   Note: Lighting internal to display cases that are attached to a wall or directly adjacent to a wall are counted as wall display. All other lighting internal to

display cases are counted as floor display lighting, or as very valuable display case lighting.

3. The length of display walls shall include the length of the perimeter walls including but not limited to closable openings and permanent full height interior partitions.

   Permanent full height interior partitions are those that meet the following conditions:

   i. Extend from the floor to within two feet of the ceiling or are taller than ten feet; and

   ii. Are permanently anchored to the floor.

4. The additional wall display lighting power is not available for the following:

   i. For any function areas using the Complete Building or Area Category methods of compliance.

   ii. General lighting systems.

   Note that floor displays shall not qualify for wall display lighting power allowances.

C. Additional Floor Display and Task Lighting Power

Floor display lighting is defined as supplementary lighting required to highlight features, such as merchandise on a clothing rack or floor mounted artwork and featured architectural elements, which are not displayed against a wall. Floor display lighting provides a higher level of illuminance to this specific area than the level of surrounding ambient illuminance.

Task Lighting is defined as lighting that specifically illuminates a location where a task is performed, but not general lighting.

Additional allowed power for floor display lighting and additional allowed power for task lighting may be used only for qualifying floor display lighting systems, qualifying task lighting systems, or a combination of both, for the listed primary function areas in Table 140.6-D.

Lighting internal to display cases that are not attached to a wall and not directly adjacent to a wall, shall be counted as floor display lighting or very valuable display case lighting.

1. The additional allowed power for the floor display and task lighting shall be the smaller of:

   a. The floor display and task lighting power density values (column 4 of Table 140.6-D) multiplied by the square footage of floor display or task area.

   b. The adjusted lighting power used for floor display lighting or task lighting.

Calculate the adjusted lighting power by multiplying the maximum rated wattage of the floor display or task luminaires with the appropriate mounting height adjustment factor from Table 140.6-E.

Note that mounting height adjustment factor is available for floor display luminaires mounted greater than 10 feet, 6 inches from the finished floor. Mounting height is the distance from the finished floor to the bottom of the luminaire.

2. To qualify for additional floor display lighting power:
   a. The floor display lighting system shall be mounted no closer than 2 feet to a wall. When track lighting is used for floor display lighting, and where portions of that lighting track are more than 2 feet from the wall and other portions are within 2 feet of the wall, only those portions of track more than 2 feet from the wall shall qualify for the floor display lighting power allowance.
   b. The floor display lighting system consists of only directional lamp types, such as PAR, R, MR, AR, or of luminaires providing directional display light.
   c. If track lighting is used, only track heads that are classified as directional lighting types.
3. To qualify for additional task lighting power:
   a. The task lighting system shall be located immediately adjacent to and capable of illuminating the task for which it is installed.
   b. The lighting system shall be of a type different from the general lighting system.
   c. The lighting system shall be separately switched from the general lighting system
4. To qualify for the additional power for floor display and task lighting, the lighting system shall be a type that is appropriate for creating a higher level of illuminance on the floor display or task.
5. The additional power for floor display and task lighting is not available for the following:
   a. Any function areas using the Complete Building or Area Category methods of compliance.
   b. Displays that are installed against a wall shall not qualify for the floor display lighting power allowances.
   c. Any floor area designed to not have floor displays or tasks, such as floor areas designated as a path of egress, shall not be included for the floor display allowance.

6. For floor areas qualifying for both floor display and task lighting power allowances, the additional allowed power shall be used only once for the same floor area so that the allowance shall not be additive.

D. Additional Decorative/Special Effects Lighting Power

Special effects lighting is defined as lighting installed to give off luminance instead of providing illuminance, which does not serve as general, task, or display lighting.

Qualifying decorative lighting includes luminaires such as chandeliers, sconces, lanterns, neon and cold cathode, light-emitting diodes, theatrical projectors, moving lights, and light color panels when any of those lights are used in a decorative manner that does not serve as display lighting or general lighting.

Additional allowed power for decorative/special effects lighting may be used only for the listed primary function areas in Table 140.6-D.

1. The additional allowed power for decorative/special effects lighting shall be the smaller of:
    a. The allowed decorative/special effects lighting power values (column 5 of Table 140.6-D) multiplied by the square footage of the floor areas having decorative/special effects lighting.
    b. The adjusted lighting power used for decorative/special effects lighting.
2. Additional decorative and special effects lighting power is not available for any function area using the Complete Building or Area Category methods of compliance.
3. Additional decorative/special effects lighting power shall be used only in areas having decorative/special effects lighting.

    Any floor area not designed to have decorative or special effects lighting shall not be included for the decorative/special effects lighting allowance.

E. Additional Very Valuable Display Case Lighting Power

Case lighting is defined as lighting of small art objects, artifacts, or valuable collections that involves customer inspection of very fine detail from outside a glass enclosed display case.

Additional allowed lighting power for very valuable display case lighting shall be available only for display cases in retail merchandise sales, museum, and religious worship areas.

1. The additional allowed power for very valuable display case lighting shall be the smallest of one of the following:
    a. The product of the area of the primary function and 0.50 watt per sq. ft.

b. The product of the area of the display case and 7 watts per sq. ft.

c. The adjusted lighting power used for very valuable display case lighting.

2. To qualify for additional allowed power for very valuable display case lighting, a case shall contain jewelry, coins, fine china, fine crystal, precious stones, silver, small art objects and artifacts, and/or valuable collections, the display of which involves customer inspection of very fine detail from outside a locked case.
3. The additional very valuable display case lighting is not available for any function areas using the complete building or area category methods of compliance.
4. Qualifying lighting includes internal display case lighting or external lighting employing highly directional luminaires specifically designed to illuminate the case or inspection area without spill light and shall not be fluorescent lighting unless installed inside of a display case.

Example 5-24: Decorative Lighting and Very Valuable Display Lighting — Tailored Method (Five Parts) (Part 1)

Question

A 5,500-ft² retail store has:

5,000 ft² of gross retail sales area (merchandise sales) with a RCR of 2.5
200 ft² of restrooms (with a RCR of 6.0)
300 ft² of corridors (with a RCR of 6.5)
100 ft² of very valuable merchandise case top with 1,200 W of light sources

As part of the retail scheme in the sales floor area, the following lighting is being used.

- Wall display lighting of 300 linear feet of perimeter wall including closeable openings
- Floor display lighting
- Decorative/special effects lighting.

What is the allowed lighting power for general lighting in this store using the Tailored Method?

Answer

The general illumination level is 500 Lux per Table 140.6-D for merchandise sales and showroom area in retail. Per Table 140.6-G, the lighting power density (LPD) is 0.90 W/ft² for a 500 Lux space with an RCR of 2.5. Therefore, the allowed general lighting power for the retail sales area is 0.90 W/ft² X 5,000 ft² = 4,500 W.

Corridors and restrooms are not included in the Tailored Method tables and therefore must comply under the area category method. Look up Table 140.6-C for the allowed LPD for these spaces. Table 140.6-C allows general lighting power LPD of 0.40 W/ft^2 for

corridors and 0.65 W/ft^2 for restrooms. *(The RCR is not used for the area category method)*

The allowed power for the restrooms is 200 ft² x 0.65 W/ft² = 130 W.

The allowed power for the corridors is 300 ft² x 0.40 W/ft² = 120 W.

Note that for the Tailored Method, the allowed wattage for each lighting task other than general lighting is of the use-it-or-lose-it variety, which prohibits trade-offs among these wattages and different tasks or areas. Only the General Lighting component of the Tailored Method is tradable between areas using tailored method or areas using area category method.

Example 5-25: Wall Display Lighting – Tailored Method (Continue – Part 2)

Question

If the adjusted lighting power of the floor display luminaires is 3,000 watts, what is the allowed wall display lighting power for the retail sales area in this store?

Answer

The wall display lighting is computed from the entire wall perimeter, including all closeable openings, multiplied by the wall display power allowance. The allowed lighting power density value (for wall display lighting in merchandise sales and showroom areas of retail sales) is 11.5 W/ft as indicated in column 3 of Table 140.6-D. Therefore, the wall display lighting is 300 ft. x 11.5 W/ft. = 3,450 W..

Note that in the Tailored Method, the wall display lighting allowance is a use-it-or-lose-it allowance.

The additional allowed power for wall display lighting is the smaller of:

- The wall display lighting power allowance of 3,450 W, as calculated from above.
- The adjusted lighting power used for the wall display lighting, 3,000 W.

Since the smaller of 3,450 W and 3,000 W is 3,000 W, the additional allowed power for wall display lighting is 3,000 W for the retail sales area in this store.

Example 5-26: Floor Display Lighting – Tailored Method (Continue – Part 3)

Question

If the adjusted lighting power of the floor display luminaires is 4,000 watts, what is the allowed floor display lighting power for this store?

Answer

The floor display allowance is computed from the area of the entire space with floor displays multiplied by the floor display lighting power density. Therefore, the allowed

wattage is 5,000 ft² x 0.7 W/ft² = 3,500 W. The allowance is taken from column 4 of Table 140.6-D.

Note that in the Tailored Method, the floor display power allowance is a use-it-or-lose-it allowance.

The additional allowed power for floor display lighting is the smaller of:

- The floor display lighting power allowance of 3,500 W, as calculated from above.
- The adjusted lighting power used for the floor display lighting, 4,000 W.

Since the smaller of 3,500 W and 4,000 W is 3,500 W, the additional allowed power for floor display lighting is 3,500 W for the retail sales area in this store.

Example 5-27: Decorative/Special Effect Lighting – Tailored Method (Continue – Part 4)

Question

If the adjusted lighting power of the decorative/special effect luminaires is 4,000 watts, what is the allowed decorative/special effect lighting power for this store?

Answer

The decorative/special effect allowance is computed from the area of the entire space with floor displays times the decorative/special effect lighting power density. Therefore, the allowed wattage is 5,000 ft² x 0.35 W/ft² = 1,750 W. The allowance is taken from column 5 of Table 140.6-D.

Note that in the Tailored Method, the decorative/special effect lighting allowance is a use-it-or-lose-it allowance.

The additional allowed power for decorative/special effect lighting is the smaller of:

- The decorative/special effect lighting power of 1,750 W, as calculated from above.
- The adjusted lighting power used for the decorative/special effect lighting, 4,000 W.

Since the smaller of 1,750 W and 4,000W is 1,750 W, the additional allowed power for decorative/special effect lighting is 1,750 W for the retail sales area in this store. The decorative/special effect lighting must be redesigned so that the adjusted wattage is reduced to no more than 1,750 W or the excess wattage must be taken from the general lighting power allowance provided there is extra wattage available.

Example 5-28: Very Valuable Display Case Lighting – Tailored Method (Continue – Part 5 of 5)

Question

If the adjusted lighting power of the very valuable display case lighting is 1,200 watts, what is the allowed very valuable display case lighting power for this store?

Answer

The allowed wattage for very valuable display case top is smaller of the product of 0.50 W/ft² and the gross sales area (5,000 ft²) or the product of 7 W/ft² and the actual area of the case tops (100 ft²) or the adjusted lighting power of the very valuable display case lighting.

The allowed lighting power is the smaller of one of the following:

- 0.50 W/ft² X 5,000 ft² = 2,500 watts
- 7 W/ft² X 100 ft² = 700 watts
- The adjusted lighting power of very valuable display case lighting, 1,200 watts.

Therefore, the additional allowed power for very valuable display case lighting is 700 W.

The very valuable display case lighting will need to be redesigned to reduce the adjusted wattage to no more than 700 W, or the excess wattage must be taken from the general lighting power allowance provided there is extra wattage available.

Example 5-29: Retail Space – Full Height Partitions

Question

A large retail store with a sales area that has a 14-foot high ceiling and full height perimeter wall also has several other walls and a high fixture element in the space. Based on the definition of "full-height" interior partitions (per §140.6[c]3Giii), which components qualify for the wall display lighting allocation?

Answer

The figure below shows full height interior partitions and partial height interior partitions.

Figure 5-23: (Example 5-29) Retail Lighting in Application — Partitions Qualifying for Wall Display Lighting Power Under Tailored Method

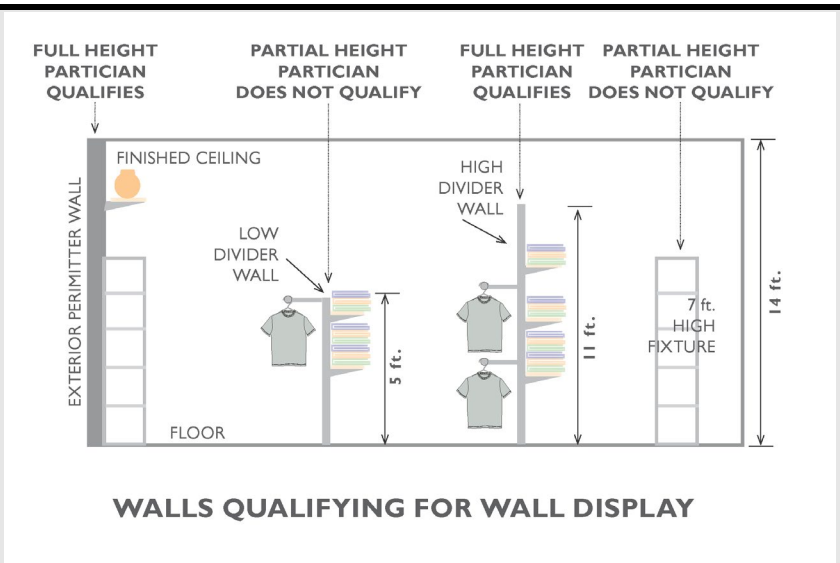


Image Source: California Energy Commission

Full height interior partitions extend from the floor to within two feet of the ceiling or are taller than 10 feet. Full height partitions must also be permanently anchored to the floor.

Example 5-30: Wall Display Lighting in a Retail Store – Tailored Method

Question

In the following figure, Condition A has 2 x 4 troffers placed 3 feet from a perimeter sales wall as well as fluorescent wall-washers 5 feet from the sales wall. Condition B has fluorescent wall-washers 3 feet from the wall and PAR adjustable accent lights 5 feet from the wall. Which luminaires qualify for the wall display lighting allocation?

Answers

Figure 5-24: (Example 5-30) Retail Lighting in Application — Walls Qualifying for Wall Display Lighting Power Under Tailored Method

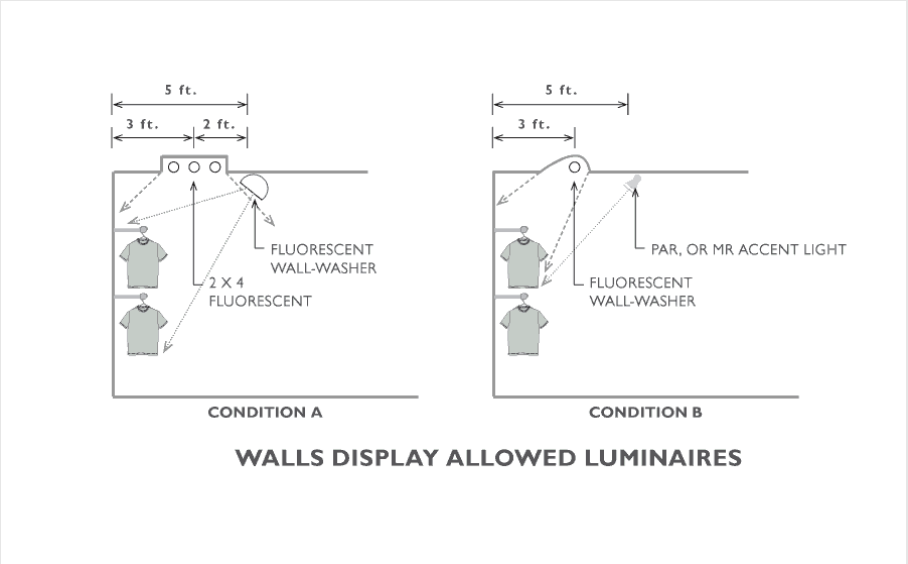


Image Source: California Energy Commission

Per §140.6(c)3Giia, qualifying lighting must be mounted within 10 feet of the wall and must be an appropriate wall lighting luminaires. (Luminaires with asymmetric distribution toward the wall or adjustable directed toward the wall).

CONDITION A

While both luminaires are within 10 feet of the wall only the wall-washer qualifies for the wall display allocation. The 2 x 4 troffer is a general lighting luminaire with symmetric distribution and does not qualify for the allocation.

CONDITION B

Both luminaires are within 10 feet of the wall, and both qualify for the wall display allocation. The fluorescent wall-washer has an asymmetric distribution and the PAR accent light at 5 feet from the wall provides directional light.

Example 5-31: Lighting Power Adjustments for Luminaire Mounting Height – Tailored Method

Figure 5-25: (Example 5-31) Lighting Power Adjustments for Luminaire Mounting Height

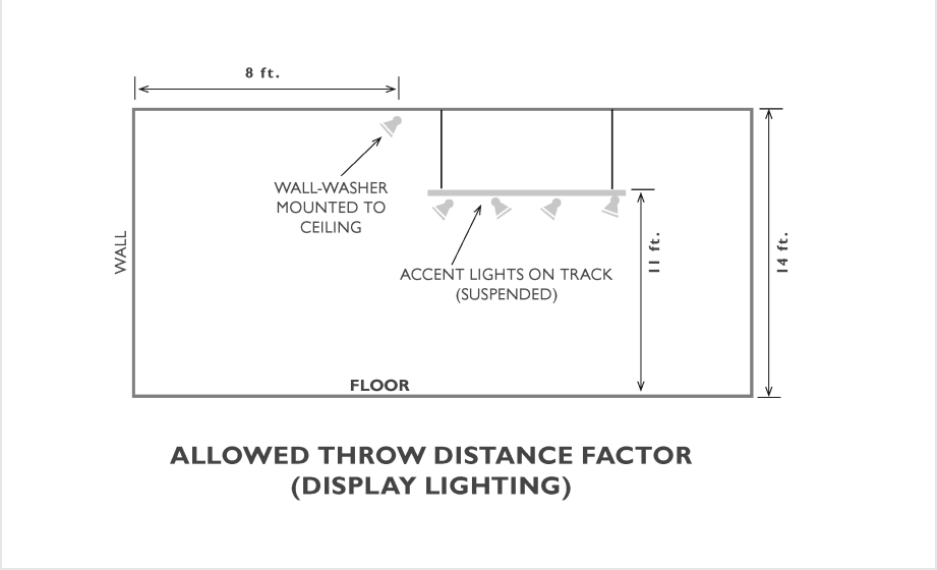


Image Source: California Energy Commission

Question

A high ceiling space with allowed display lighting has wall-washers mounted on the ceiling near the wall and accent lights mounted on suspended track in the center of the space. Because of the 14-foot high ceiling, does the display lighting qualify for a mounting height factor adjustment?

Answer

Per §140.6(c) 3Giv and 3Hviii, both the wall-washers and accent lights qualify for the mounting height adjustment as they are mounted at height greater than 10 feet 6 inches and they also provide directional light.

If the track is suspended at 10 feet instead of 11 feet, it is excluded from an adjustment factor and must use the default factor of one with the allowed LPD as shown in column four in Table 140.6-E.

5.8 Performance Compliance Approaches

The performance approach is an alternative to the prescriptive approach. The allowed lighting power is calculated as part of the energy budget for the proposed design building. A building complies with the performance approach if the energy budget calculated for the proposed design building is no greater than the energy budget calculated for the standard design building.

Under the performance approach, the energy use of the building is modeled using a compliance software program approved by the CEC. In this energy analysis, the standard lighting power density for the building is determined by the compliance software program based on occupancy type, in accordance with either the complete building, area category, or tailored method described above. This standard lighting power density is used to determine the energy budget for the building.

When a lighting permit is sought under the performance approach, the applicant uses a proposed lighting power density to determine whether or not the building meets the energy budget. If it does, this proposed lighting power density is automatically translated into the allowed lighting power for the building (by multiplying by the area of the building).

If the building envelope or mechanical systems are included in the performance analysis (because they are part of the current permit application), then the performance approach allows energy trade-offs between systems that can let the allowed lighting power go higher than any other method. Alternatively, it allows lighting power to be traded away to other systems, which would result in a lower allowed lighting power. This flexibility in establishing allowed lighting power is one of the more attractive benefits of the performance approach.

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

Trade-offs in general lighting power are allowed between all spaces using the Area Category Method, between all spaces using the Tailored Method, and between all spaces using the Area Category and Tailored Methods.

Also, with the Area Category Method and the Tailored Method, the Energy Code provides an additional lighting power allowance for special cases. Each of these lighting system cases is treated separately as "use-it-or-lose-it" lighting. The user receives no credit (standard design matches proposed), but there is a maximum power allowance for each item.

See the 2022 Nonresidential ACM Reference Manual for additional information.

5.9 Lighting Control Installation and Acceptance Requirements – for Installers and Acceptance Test Technicians

With the onset of the construction phase of projects, two types of documentation must be prepared for showing compliance to the Energy Code — certificate of installation and certificate of acceptance.

The following sections layout the scope of these types of certification and the related parts of the Nonresidential Appendix that contain the acceptance testing procedures. Refer to Section 5.11 for a list of certificate of installation and certificate of acceptance documents.

5.9.1 Lighting Installation Certificate Requirements (§130.4[b])

The person eligible under Division 3 of the Business and Professions Code to accept responsibility for the installation or construction of features, materials, components, or manufactured devices shall sign and submit the certificate of installation for installation of the following items before any of the following applications will be recognized for compliance with the lighting requirements:

1. Lighting Control System
2. Energy Management Control System
3. Interlocked lighting systems serving a single space.
4. Lighting controls installed to earn a lighting power adjustment factor (PAF)
5. Additional lighting wattage available for a videoconference studio

If any of the requirements in the certificate of installation are not met, that application shall not be recognized for compliance with the Energy Code.

See Section 5.11.6 for more information on certificate of installation documents.

5.9.2 Lighting Control Acceptance Requirements (§130.4[a])

Acceptance testing must be performed by a certified lighting controls acceptance test technician to certify the indoor and outdoor lighting controls serving the building, area, or site will meet the acceptance requirements.

A certificate of acceptance shall be submitted to the local enforcement agency under §10-103(a) of Part 1 and §130.4(a), that:

1. Certifies that all of the lighting acceptance testing necessary to meet the requirements of Part 6 is completed.
2. Certifies that the applicable procedures in Reference Nonresidential Appendix NA7.6 and NA7.8 have been followed.
3. Certifies that automatic daylight controls comply with §130.1(d) and Reference Nonresidential Appendix NA7.6.1.
4. Certifies that lighting shut off controls comply with §130.1(c) and Reference Nonresidential Appendix NA7.6.2.
5. Certifies that demand-responsive controls comply with §130.1(e) and Reference Nonresidential Appendix NA7.6.3.
6. Certifies that outdoor lighting controls comply with the applicable requirements of §130.2(c) and Reference Nonresidential Appendix NA7.8.

7. Certifies that lighting systems receiving the institutional tuning power adjustment factor comply with §140.6(a)2J and Reference Nonresidential Appendix NA7.6.4.

5.10 Additions and Alterations

5.10.1 Overview

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 may be traded-off against other system energy budgets.

Alterations to indoor lighting systems that include 10 percent or more of the existing luminaires serving an enclosed space must meet the indoor lighting alteration requirements in §141.0(b)2I. Indoor lighting alterations include adding luminaires, removing and reinstalling luminaires, modifying luminaires, or combining the replacement of lamps and ballasts or drivers. Alterations to wiring serving lighting are also lighting alterations.

Any space with a lighting system installed for the first time must meet the same lighting requirements as a newly constructed building.

5.10.2 Additions

§141.0(a)

The nonresidential indoor lighting of the addition shall meet either the prescriptive approach or the performance approach.

When using the prescriptive approach, the indoor lighting in the addition must meet the lighting requirements of §110.0, §110.9, §130.0 through §130.5, §140.3, and §140.6.

When using the performance approach, the indoor lighting in the addition must meet the lighting requirements of §110.0, §110.9, §130.0 through §130.5, and one of the following two options of the performance requirements:

1. The addition alone meet §140.1
2. The existing building plus the addition plus the alteration.

5.10.3 Alterations – General Information

§141.0(b)

5.10.3.1 Scope

Alterations to existing nonresidential, hotel/motel, or relocatable public-school buildings or alterations in conjunction with a change in building occupancy to a nonresidential, or hotel/motel occupancy shall meet one of the following requirements:

i. Comply with the requirements for additions.

ii. Comply with the prescriptive lighting requirements.

iii. Comply with the performance approach.

An alteration as defined by the Energy Code includes:

i. Any change to a building water-heating system, space-conditioning system, lighting system, electrical power distribution system, or envelope that is not an addition.

ii. Any regulated change to an outdoor lighting system that is not an addition

iii. Any regulated change to signs located either indoors or outdoors.

iv. Any regulated change to a covered process that is not an addition.

An altered component is defined by the Energy Code as a component that has undergone an alteration and is subject to all applicable requirements.

5.10.3.2 Indoor Lighting Alteration Exceptions

The following indoor lighting alterations are not required to comply with the lighting requirements in the Energy Code:

1. Alterations where less than 10 percent of existing luminaires in an enclosed space are being altered.
2. Alteration of portable luminaires, luminaires affixed to moveable partitions, or lighting excluded by §140.6(a)3.
3. In an enclosed space where there is only one luminaire.
4. Any alteration that would directly cause the disturbance of asbestos unless the alterations are made in conjunction with asbestos abatement.
5. Alterations limited to addition of lighting controls or replacing lamps, ballasts, or drivers.
6. One-for-one luminaire alteration of up to 50 luminaires either per complete floor of the building or per complete tenant space, per annum.

5.10.3.3 Skylight Exception

When the daylighting control requirements of §130.1(d) are triggered by the addition of skylights to an existing building and the lighting system is not re-circuited, the daylighting control need not meet the multilevel requirements in §130.1(d). Daylit areas must be controlled separately from nondaylit areas. An automatic control must be able to reduce lighting power by at least 90 percent when the daylit area is fully illuminated by daylight.

5.10.3.4 Alterations – Performance Approach

When using the Performance Approach (using a software program certified to the Energy Commission) the altered envelope, space conditioning system, lighting and water heating components, and any newly installed equipment serving the alteration shall meet the applicable requirements of §110.0 through §110.9, §120.0 through §120.6, and §120.9 through §130.5.

5.10.3.5 Alterations – Prescriptive Approach

When using the Prescriptive Approach, the altered lighting shall meet the applicable requirements of §110.0, §110.9, and §130.0 through §130.4.

5.10.4 Indoor Lighting Alterations

§141.0(b)2I

Alterations to the lighting systems must comply with the requirements in §141.0(b)2I when 10 percent or more of the luminaires serving an enclosed space are altered.

The Energy Code compliance goals for the lighting alterations are twofold. First, the installation must meet the lighting power requirements; second, the installation must provide lighting controls.

The Energy Code allows three options for meeting the installed power and associated control requirements and specifies a set of requirements for lighting power allowance and controls for each of the following cases:

1. The altered lighting power does not exceed the indoor lighting power requirements specified in §140.6,
2. The altered lighting power is equal to or less than 80 percent of indoor lighting power requirements specified in §140.6, or
3. The alteration is a one-for-one luminaire alteration within a building or tenant space of 5,000 sq. ft. or less, and the total wattage of the altered luminaires is at least 40 percent lower compared to the total prealteration wattage.

Altered lighting systems must meet one of the three requirements above for lighting power allowance. Options 1 and 2 require the lighting power allowance to be calculated according to §140.6.

Option 3 allows the maximum installed lighting power to be determined by taking a percentage of the existing installed lighting power, rather than measuring the square footage of the space and multiplying it by a lighting power allowance. Option 3 is allowed only for one-for-one luminaire alterations. One-for-one is defined as either replacement of whole luminaires one for one, in which the only electrical modification involves disconnecting the existing luminaire and reconnecting the replacement luminaire, or when components of a luminaire are modified without replacing the entire luminaire.

5.10.4.1 Indoor Lighting Alteration Control Requirements

The control requirements for each option are described in Table 5-3.

Option 1 requires indoor lighting alterations to meet all the mandatory control requirements that are applicable to the project. The control requirements include manual area controls, multilevel controls, automatic shutoff controls, daylighting controls, and demand-responsive controls.

Options 2 and 3 are likely to result in a lower lighting power than Option 1; therefore, indoor lighting alterations must meet manual area control and automatic shut off control requirements. In offices larger than 250 square feet, occupant sensing shutoff controls are not required for Options 2 and 3. Multilevel lighting controls (§130.1[b]), daylighting controls (§130.1[d]), and demand-responsive controls (§130.1[e]) are not required for Options 2 and 3.

Alterations to indoor lighting systems shall not prevent the operation of existing, unaltered controls and shall not alter controls to remove functions specified in §130.1. 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 §130.1(a)4 and 130.1(c)1D.

The acceptance testing requirement of §130.4 is not required for alterations where lighting controls are added to control 20 or fewer luminaires for the entire alteration project.

Table 5-3 (Modified from Table 141.0-F): Control Requirement for Indoor Lighting Alteration

Control Specifications	Control Specifications	Projects complying with §141.0(b)2Ii (Option 1)	Projects complying with §141.0(b)2Iii and §141.0(b)2Iiii (Option 2 and 3)
Manual Area Controls	130.1(a)1	Required	Required
Manual Area Controls	130.1(a)2	Required	Required
Manual Area Controls	130.1(a)3	Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Multilevel Controls	130.1(b)	Required	Not Required
Automatic Shut Off Controls	130.1(c)1	Required; 130.1(c)1D only required for new or completely replaced circuits	Required; 130.1(c)1D only required for new or completely replaced circuits
Automatic Shut Off Controls	130.1(c)2	Required	Required
Automatic Shut Off Controls	130.1(c)3	Required	Required

Control Specifications	Control Specifications	Projects complying with §141.0(b)2Ii (Option 1)	Projects complying with §141.0(b)2Iii and §141.0(b)2Iiii (Option 2 and 3)
Automatic Shut Off Controls	130.1(c)4	Required	Required
Automatic Shut Off Controls	130.1(c)5	Required	Required
Automatic Shut Off Controls	130.1(c)6	Required	Required; except for 130.1(c)6D
Automatic Shut Off Controls	130.1(c)7	Required	Required
Automatic Shut Off Controls	130.1(c)8	Required	Required
Daylighting Controls	130.1(d)	Required	Not Required
Demand-Responsive Controls	130.1(e)	Required	Not Required

Example 5-32: Warehouse Luminaire Alteration With 40 Percent Lighting Power Reduction

Question

All existing luminaires in a warehouse facility of 5,000 sq. ft. are proposed to be replaced by LED luminaires (shown below). There are 100 existing metal halide luminaires, and

each uses 250 watts, all of which will be replaced. The replacement LED luminaires use 150 watts each. How is compliance being determined, and what controls are required?

Answer

The compliance option of §141.0(b)2Iiii requires a 40 percent reduction in installed lighting power for one-to-one luminaire alterations within a building or tenant space of 5,000 square feet or less. Thus, enter the number and wattage of the existing luminaires into NRCC-LTI, and use the form to calculate both the existing installed lighting power (100 x 250 W = 25,000 W) and the maximum allowance based on a 40 percent reduction (25,000 W x 0.6 = 15,000 W). Enter the number and wattage of the new luminaires into NRCC-LTI, just like any other project. This is a one-for-one replacement, so the total lighting power of the new luminaires meets the allowance (100 x 150 W = 15,000 W).

Since the alteration meets §141.0(b)2Iiii, only manual area controls and automatic shut off controls are mandatory as specified in Table 141.0-F (Table 5-2 in this manual).

Example 5-33: Lighting Wiring Alterations

Question

If the lighting system is being rewired as part of a lighting alteration project, which Energy Code requirements must be complied with?

Answer

Alterations to lighting wiring are considered alterations to the lighting system, so the requirements are the same as for lighting system alterations. Only altered components of the alteration must meet applicable requirements. For example, rewiring or relocating existing controls will trigger applicable requirements for the existing controls. If existing luminaires are not altered, they would not be held to alteration requirements such as lighting power allowance requirements or additional control requirements in §141.0(b)2I.

Altered lighting circuits must comply with the control requirements as specified in §130.1(a)3.

The acceptance testing requirements are triggered if controls are added to control more than 20 luminaires.

Example 5-34: Alterations Projects Replacing Both Lamps and Ballasts of the Luminaires

Question

There are 100 lighting fixtures in an existing office space. For 20 fixtures, the internal components (lamps and ballasts) are being replaced with retrofit kits.

Which Energy Code requirements apply?

Answer

Because 20 out of 100 (or 20 percent) of the luminaires are altered, which is more than the 10 percent of existing luminaires in the space, the alteration must meet either §141.0(b)2Ii or §141.0(b)2Iii. Moreover, removing and replacing both lamps and ballasts with retrofit kits are considered one-for-one luminaire alteration. Therefore, the alteration could meet §141.0(b)2Iiii instead of §141.0(b)2Ii or §141.0(b)2Iii if the total wattage of the altered luminaires has been reduced by at least 40 percent and if the altered building or tenant space is 5,000 square feet or less.

Example 5-35: One-for-One Alterations in Enclosed Spaces With One Luminaire

Question

A project includes more than 50 luminaires with one-for-one alterations on a floor, but a portion of those altered luminaires are in enclosed spaces containing one luminaire.

How are the luminaires in the enclosed spaces counted toward the trigger threshold of 50 luminaires under §141.0(b)2I in a one-for-one luminaire alteration?

Answer

Although Exception 2 to §141.0(b)2I exempts enclosed spaces with one luminaire from the requirements of §141.0(b)2I, it does not reduce the total luminaire count on a floor or a tenant space. Therefore, the altered luminaires on the floor that are not in the spaces with one luminaire are required to meet the requirements of either §141.0(b)2Ii, §141.0(b)2Iii, or §141.0(b)2Iiii.

Example 5-36: Lamp Replacements as Part of a Project

Question

A single-story retail store has 50 T12 linear fluorescent strip luminaires and two sections of track lighting. One of the tracks has 10 screw-in incandescent flood lights and the other track has 10 pin-based halogen PAR lamps. The linear luminaires are being retrofitted with T8 lamps and premium ballasts. In the track luminaires, the screw-in and pin-based incandescent lamps are being replaced with equivalent screw-in and pin-based LED lamps. There are no other alterations done to the lighting system of that tenant space in the calendar year.

What are the Energy Code requirements for this project?

Answer

There are a total of 70 luminaires (50+10+10 = 70 luminaires).

Out of the 70 fixtures included in the project, the 20 incandescent fixtures consist of lamp replacement only and do not count toward the trigger threshold of more than 50

luminaires under §141.0(b)2I (one-for-one luminaire alteration). Only 50 luminaires are being altered in this job. The Energy Code is not triggered for this project because 50 or fewer fixtures are being modified.

Example 5-37: Energy Code for Lighting Wiring Alterations

Question

If occupancy sensing controls are added to a suite of office spaces, does this addition trigger the requirements of §141.0(b)2I (Indoor Lighting Alterations)?

Answer

No, since the alterations are limited to the addition of occupancy sensing controls, it does not trigger any of the requirements of §141.0(b)2I.

Example 5-38: Daylighting Requirements for Large Enclosed Spaces

Question

A 30,000 ft² addition has a 16,000 ft² space with an 18-ft. high ceiling and a separate 14,000 ft² space with a 13 ft high ceiling. The lighting power density in this building is 1 W/ft². Do skylights have to be installed in the portion of the building with 18-foot ceiling?

Answer

Yes. Section 140.3(c) requires daylighting in enclosed spaces that are greater than 5,000 ft² directly under a roof with a ceiling height over 15 feet. In this example the area with a ceiling height greater than 15 feet is 16,000 ft²; therefore, prescriptive daylighting requirements apply. (Note: Daylighting requirements do not apply in Climate Zones 1 and 16).

Example 5-39: Daylighting Requirements for Alterations

Question

A preexisting air-conditioned 30,000 ft² warehouse with a 30 ft. ceiling and no skylights will have its general lighting system replaced as part of a conversion to a big box retail store. Are skylights prescriptively required?

Answer

No. The general lighting system is being replaced and is not "installed for the first time." Thus, §141.0(b)2F does not apply and therefore does not trigger the requirements in §140.3(c) for daylighting.

5.11 Indoor Lighting Compliance Documents

5.11.1 Overview

This subchapter describes the documentation (compliance forms) required for compliance with the nonresidential indoor lighting requirements of the Energy Code.

5.11.2 Submitting Compliance Documentation

At the time a building permit application is submitted to the local enforcement agency, the applicant also submits building plans and energy compliance documentation. This section describes the recommended compliance documentation (forms) for complying with the nonresidential indoor lighting Energy Code. It does not describe the details of the requirements.

This section is addressed to the person preparing building plans and compliance documents and to the local enforcement agency plan checkers who are examining those documents for compliance.

5.11.3 Separately Documenting Conditioned and Unconditioned Spaces

The nonresidential indoor lighting requirements are the same for conditioned and unconditioned spaces. However, the Energy Code does not allow lighting power trade-offs to occur between conditioned and unconditioned spaces. Therefore, most nonresidential indoor lighting compliance forms are required to be separately completed for conditioned and unconditioned spaces.

5.11.4 Compliance Documentation Numbering

Following is an explanation of the nonresidential lighting compliance documentation numbering:

- NRCC Nonresidential Certificate of Compliance.
- NRCA Nonresidential Certificate of Acceptance.
- NRCI Nonresidential Certificate of Installation.
- LTI Lighting, Indoor.
- LTO Lighting, Outdoor.
- LTS Lighting, Sign.
- E Primarily used by enforcement authority.
- A Primarily used by acceptance tester.

5.11.5 Certificate of Compliance Documents

There is only one nonresidential indoor lighting certificate of compliance document (form) required to be filled out for each project.

- NRCC-LTI-E; Certificate of Compliance; Indoor Lighting.

The certificate of compliance must be submitted for all buildings that demonstrate compliance with the nonresidential indoor lighting requirements. The certificate of compliance documents installed lighting power, lighting power allowance calculations, mandatory controls, PAFs, and other lighting requirements in the Energy Code.

5.11.6 Certificates of Installation Documents

There are six certificates of installation listed as follows. See Section 5.9.1 of this chapter for additional information.

- NRCI-LTI-01-E, Certificate of Installation, Indoor Lighting
- NRCI-LTI-02-E, Certificate of Installation, Lighting Control Systems
- NRCI-LTI-04-E, Certificate of Installation, Two Interlocked Lighting Systems
- NRCI-LTI-05-E, Certificate of Installation, Power Adjustment Factors
- NRCI-LTI-06-E, Certificate of Installation, Additional Video Conference Studio Lighting

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 nonresidential indoor lighting certificates of installation include the following:

- NRCI-LTI-01-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.

In addition to the NRCI-LTI-01-E, the following certificates of installation are also required if the job includes any of the measures covered by these certificates of installation. If any of the requirements in any of these certificates of installation fail the respective installation requirements, then that application shall not be recognized for compliance with the lighting standards.

- NRCI-LTI-02-E — Must be submitted whenever a lighting control system, and whenever an energy management control system (EMCS), have been installed to comply with any of the lighting control requirements.
- NRCI-LTI-04-E — Must be submitted for two interlocked systems serving an auditorium, a convention center, a conference room, a multipurpose room, or a theater to be recognized for compliance.

  See Section 5.6.2 of this chapter for two interlocked system requirements.
- NRCI-LTI-05-E — Must be submitted for a power adjustment factor (PAF) to be recognized for compliance.

  See Section 5.6.2 of this chapter for requirements of PAFs.

- NRCI-LTI-06-E — Must be submitted for additional wattage installed in a video conferencing studio to be recognized for compliance

5.11.7 Certificate of Acceptance

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

- Visual inspection of the equipment and installation.
- 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, §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.

The acceptance tests required for nonresidential indoor lighting include:

- Shutoff controls.
- Automatic daylighting controls.
- Demand-responsive lighting controls and demand-responsive controlled receptacles.
- Institutional tuning controls that qualify for a power adjustment factor.

Instructions for completing the certificates of acceptance are imbedded in the certificates. The lighting controls acceptance testing procedures are included in Nonresidential Reference Appendix NA7.6.

See Chapter 14 of this manual for additional information about acceptance requirements.

5.12 For Manufacturers and Installers

Lighting controls are no longer required to comply with Title 20 Appliance Efficiency Regulations effective March 16, 2021. Amendments to Title 20 removed the requirements for self-contained lighting controls therefore lighting controls are no longer required to comply with Title 20 to be sold or offered for sale in California or to be certified and listed in the web page, which is under the heading "Modernized Appliance Efficiency Database System (MAEDBS)."

5.12.1 Luminaire Labeling

130.0(c)1

Luminaires shall be labeled with its wattage as follows.

1. 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
2. Peel-off and peel-down labels that allow the maximum labeled wattage to be changed are prohibited, except for luminaires meeting the following requirements:
    a. The luminaires can accommodate a range of lamp wattages without changing the luminaire housing, ballast, transformer, or wiring.
    b. They have a single lamp.
    c. They have an integrated ballast or transformer.
    d. Peel-down labels are layered such that the rated wattage reduces as successive layers are removed.
    e. Qualifies as one of the following three types of luminaires:
        i. High-intensity discharge luminaires having an integral electronic ballast with a maximum relamping rated wattage of 150 watts.
        ii. Low-voltage luminaires (does not apply to low-voltage track systems) ≤ 24 volts with a maximum relamping rated wattage of 50 watts.
        iii. Compact fluorescent luminaires having an integral electronic ballast with a maximum relamping rated wattage of 42 watts.

Informational notes about UL 1598, 1574, 2108 and 8750:

The UL 1598 (Standard for Safety for Luminaires) applies to luminaires for use in nonhazardous locations and that are intended for installation on branch circuits of 600 V nominal or less between conductors in accordance with National Electrical Code. It does not apply to luminaires covered by other standards.

The UL 1574 (Standard for Safety for Track Lighting Systems) applies to track lighting systems intended for permanent connection to sources of supply in commercial or residential ordinary locations in accordance with the National Electrical Code.

The UL 2108 (Standard for Safety for Low Voltage Lighting Systems) applies to low voltage lighting systems and components intended for permanent installation and for use in locations in accordance with the National Electrical Code.

The UL 8750 (Standard for Safety for Light-Emitting Diode (LED) Equipment for Use in Lighting Products) applies to LED equipment that is an integral part of a luminaire or other lighting equipment. These requirements cover components including LED drivers, controllers, arrays (modules), and packages as defined within this standard.