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5. Nonresidential Indoor Lighting

This chapter covers the requirements for indoor lighting design and installation, including controls, for both conditioned and unconditioned nonresidential buildings. It is addressed primarily to lighting designers or electrical engineers and to enforcement agency personnel responsible for lighting and electrical plan checking and inspection. Chapter 6 addresses nonresidential outdoor lighting applications, and Chapter 7 addresses indoor and outdoor sign lighting.

Indoor lighting is one of the single largest consumers of energy (kilowatt-hours) in a commercial building, representing about a third of electricity use. The objective of the Standards is the effective reduction of this energy use, without compromising the quality of lighting or task work. The Standards are the result of the involvement of many representatives of the lighting design and manufacturing community, and of enforcement agencies across the state. A great deal of effort has been devoted to making the lighting requirements practical and realistic.

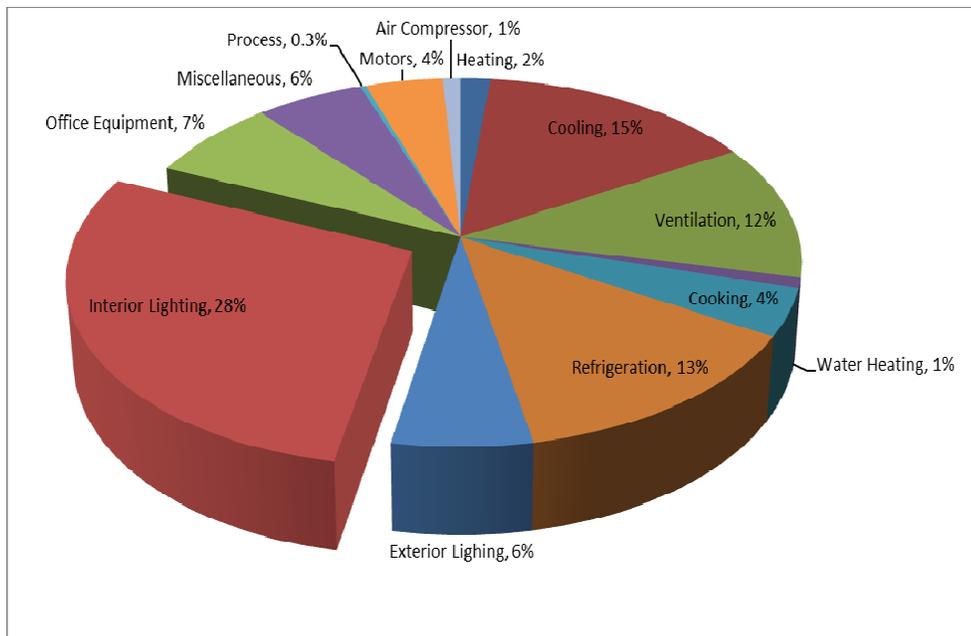


Figure 5-1 – Lighting Energy Use

Lighting accounts for about one third of commercial building electricity use in California. Source California Commercial End-Use Survey (CEUS), March 2006, California Energy Commission No. 400-2006-005

5.1 Overview

The primary mechanism for regulating indoor lighting energy under the Standards is to limit the allowed lighting power in watts installed in the building. Other mechanisms require basic equipment efficiency, and require that the lighting is controlled to permit efficient operation.

5.1.1 Significant Changes in 2013

The significant changes for the nonresidential indoor lighting in the 2013 update to the Standards includes an increased number of steps for mandatory multi-level lighting controls, daylighting control requirements are mandatory without exceptions, and the threshold for when alterations must comply with the Standards has been reduced from when 50% of the luminaires in a room are altered, to when 10% of the luminaires in a room are altered.

5.1.2 Scope and Application

- A. The nonresidential indoor lighting Standards apply to nonresidential, high-rise residential, and hotel/motel occupancies.
- B. The nonresidential indoor lighting Standards are the same for unconditioned spaces as they are for conditioned spaces, except that trade-offs are not allowed between unconditioned and conditioned spaces.
- C. Some function areas within a few buildings typically classified as residential are required to comply with the nonresidential indoor lighting Standards, such as the common area in a low-rise multi-family residential building when there is greater than 20% common area in the building (§150.0(k)12).
- D. Some function areas in nonresidential, high-rise residential, and hotel/motel occupancies are required to comply with the residential lighting Standards (section 5.2.1 of this chapter).

The residential lighting Standards are covered in chapter 6 of the 2013 Residential Compliance Manual.

E. Hotel and Motel Guest Rooms.

The 2013 Standards have several new lighting requirements for hotel and motel guest rooms, as follows:

1. Shall have captive card key controls, occupancy sensing controls, or other automatic controls that automatically turn off the lighting within 30 minutes after the guest room has been vacated (§130.0(c)8).

There is an exception to this requirement. One high efficacy luminaire (as defined in TABLE 150.0-A or 150.0-B) that is switched separately and where

the switch is located within 6 feet of the entry door is not required to automatically turn off within 30 minutes.

2. For hotel and motel guest rooms at least one-half of the 120-volt receptacles in each guest room shall be controlled receptacles that comply with §130.5(d)1, 2, and 3. Electric circuits serving controlled receptacles shall have captive card key controls, occupancy sensing controls, or automatic controls such that, no longer than 30 minutes after the guest room has been vacated, the power is switched off (§130.5(d)).

F. Stairwells.

Lighting in stairwells and common area corridors which provide access to guestrooms and dwelling units of high-rise residential buildings and 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 (§130.0(c)7).

There is an exception to this requirement. In 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 50%).

G. Historic Buildings

Exception 1 to §100.0(a) states that qualified historic buildings, as regulated by the California Historical Building Code (Title 24, Part 8 or California Building Code, Title 24, Part 2, Volume I, Chapter 34, Division II) are not covered by the Standards. However, non-historical components of the buildings, such as new or replacement mechanical, plumbing, and electrical (including lighting) equipment, additions and alterations to historic buildings, and new appliances in historic buildings may need to comply with the Standards and Appliance Efficiency Regulations, as well as other codes. For more information about energy compliance requirements for Historic Buildings, see section 1.7.1, Building Types Covered, in Chapter 1 of this manual.

5.1.3 Mandatory Measures

§130.0 through §130.4

Some requirements in the nonresidential lighting Standards are classified as “Mandatory Measures,” because they are required to be met regardless of the compliance approach used. There are no alternate options for substituting the Mandatory Measures. There are no options to not comply with the Mandatory Measures. Details about the Mandatory Measures are in sections 5.2 through 5.4 of this chapter.

5.1.4 Lighting Power Allotments

Lighting Power Allotments are the established maximum lighting power (typically watts per square foot) that can be installed based upon the compliance approach used, the building type, and the type of primary function 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 entire building's lighting system is designed and permitted at one time, and when at least 90 percent of the building is one primary type of use, as defined specifically in §100.1(b). In some cases, the complete building method may be used for an entire tenant space in a multi-tenant building. A single Lighting Power Density Allotment value governs the entire building §140.6(b)1. See section 5.5.1.
- B. **Prescriptive Approach – Area Category Method:** applicable for any permit situation, including tenant improvements. Lighting power values are assigned to each of the major function areas of a building (offices, lobbies, corridors, etc.) This approach provides some flexibility to accommodate special tasks, by providing an additional power allowance under some circumstances. See section 5.5.2.
- 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 in specific task areas. 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. When using the Tailored method, the Area category method shall be used for the remainder of the interior lighting in the building. See section 5.5.3.
- D. **Performance Approach:** applicable when the designer uses an Energy Commission-certified compliance software program to demonstrate that the proposed building's energy consumption, including lighting power, meets the energy budget. The performance approach incorporates one of the three previous methods which set the appropriate Lighting Power Allotment used in calculating the building's custom energy budget.

The Performance Approach allows energy allotments to be traded between mechanical, envelope, and lighting systems. Such trade-offs can only be made when permit applications are sought for those systems involved. For example, under the performance approach, a building with an envelope or mechanical system that is more efficient than the prescriptive efficiency requirements may be able to meet the energy budget for a standard designed building with a bit more lighting power than allowed under the three prescriptive lighting approaches.

No additional lighting power allotment is gained by using the Performance Method when not trading energy from the mechanical or envelope systems. Therefore, it does not make sense to use the Performance Approach for lighting alone. The Performance Approach may only be used

to model the performance of lighting systems that are covered under the building permit application. See section 5.6 and Chapter 11 of this document.

5.1.5 Forms, Plan Check, Inspection, Installation, and Acceptance Tests

Chapter 2 of this manual provides an overview of the documentation requirements and the process of complying with the Standards. Additionally, acceptance requirements are covered in section 5.7.3, installation certificates are explained in section 5.2.6, and lighting plan check documents are covered in section 5.10.1 of this chapter.

This process includes providing documentation that shows a building complies with all of the pertinent requirements of the Standards. After this is reviewed and approved during plan check, construction may begin. During and after construction, installers must post or submit Installation Certificates to verify that all equipment has met the requirements listed in the Certificate of Compliance; and there are periodic field inspections to assure that all required energy features are installed. At the end of construction, acceptance tests are performed on HVAC and lighting controls to assure they are installed and work correctly.

If inspections or acceptance testing uncover systems that are not installed as shown in the plans and documentation, or are found not to be operating correctly through acceptance testing, these defects have to be fixed before the building is approved. Once approved by the code official as complying with all the building code requirements including the energy code, the building receives a Certificate of Occupancy.

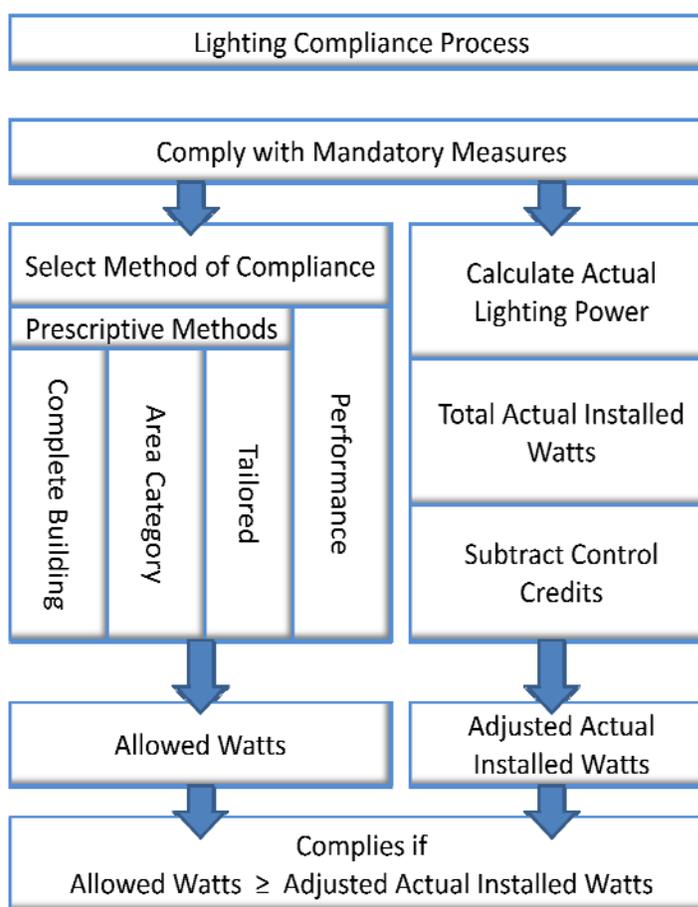


Figure 5-2 – Lighting Compliance Flowchart

5.1.6 The Lighting Compliance Process

Figure 5-2, above, shows the process for complying with the nonresidential indoor lighting Standards.

Following the left side of Figure 5-2:

First, the Mandatory Measures are required regardless of the compliance method selected (See sections 5.2 through 5.4).

Next, select a method for complying with the Standards. There are three Prescriptive compliance methods: Complete Building Method, Area Category Method, and Tailored Method (See sections 5.6 through 5.8); and there is a Performance Method (See section 5.8), where compliance is demonstrated using one of the software programs that has been approved by the Energy Commission.

This process will determine how many watts of lighting power are allowed to be installed in the building.

Following the right side of Figure 5-2:

First, calculate the actual lighting power installed by totaling all of the lighting installed in the building (See section 5.3).

Next, subtract lighting control credits (See section 5.6).

This process will demonstrate the adjusted actual watts of lighting power that has been installed in the building.

Conclusion

If the lighting power that is allowed to be installed in the building, is equal to or greater than the adjusted actual watts installed, then the lighting in the building complies with the Standards. If the lighting in the building does not comply with the Standards, then either the lighting power will need to be reduced, or additional lighting credits will need to be acquired.

5.2 Mandatory Measures

Some requirements in the nonresidential lighting Standards are classified as “Mandatory Measures,” because they are required regardless of the compliance approach used. There are no alternate options for substituting the Mandatory Measures. There are no options to not comply with the Mandatory Measures.

It is the responsibility of the designer to specify products that meet these requirements. It is the responsibility of the installer to comply with all of the mandatory requirements, even if the plans mistakenly do not. Code enforcement officials, in turn, must check that the mandatory features and specified devices are installed.

The mandatory measures for nonresidential indoor lighting include the following:

- Some functional areas in nonresidential buildings are required to comply with the residential lighting Standards (Section 5.2.2 of this chapter)
- Certification of manufactured lighting control devices and systems, ballasts, and luminaires (Section 5.2.2 of this chapter)
- Compliance with the California Appliance Efficiency Regulations (Title 20) (Section 5.2.2 of this chapter)
- Rules for how luminaires shall be classified according to technology, and how installed lighting power shall be determined (Section 5.3 of this chapter)
- Indoor lighting controls that shall be installed, which include: Area controls, multi-level controls, automatic shut-OFF controls, daylighting controls, and demand responsive controls (Section 5.4 of this chapter)
- Lighting control acceptance testing required (Section 5.4.6 of this chapter)
- Lighting control installation certificates required (Section 5.4.7 of this chapter)
- Although not related exclusively to lighting, there are mandatory measures for electrical power distribution systems, which include the following: Disaggregation of electrical circuits; voltage drop; circuit controls for 120-volt receptacles; specifications for demand responsive controls and equipment; and. specifications for energy management control systems.

See Chapter 8 of this manual for additional information about mandatory measures for electrical power distribution systems.

5.2.1 Residential Function Areas in Nonresidential Buildings

The following function areas in nonresidential, high-rise residential, and hotel/motel occupancies are required to comply with the residential lighting Standards (§130.0(b)).

1. High-rise residential dwelling units.

2. Outdoor lighting that is attached to a high-rise residential or hotel/motel building, and is separately controlled from the inside of a dwelling unit or guest room.
3. Fire station dwelling accommodations.
4. Hotel and motel guest rooms.
5. Dormitory and senior housing dwelling accommodations.

In buildings containing these residential type functional areas, all other functional areas, such as common areas, shall comply with the applicable nonresidential lighting Standards.

5.2.2 Certification Requirements for Manufactured Lighting Equipment, Products, and Devices

§100.0(h)

The Standards limit the installation of manufactured lighting equipment, products, and devices as follows:

- A.** For all lighting items that are regulated by the Title 20 Appliance Efficiency Regulations, installation shall be limited to those that have been certified to the Energy Commission by their manufacturer, pursuant to the provisions of Title 20 Cal. Code of Regulations, §1606, to meet or exceed minimum specifications or efficiencies adopted by the Commission.

Once a device is certified, it will be listed in the Directory of Automatic Lighting Control Devices, which is available from the link below:

<http://www.energy.ca.gov/appliances/database/>

Call the Energy Hotline at 1-800-772-3300 to obtain more information.

- B.** For lighting products required to be Certified to the Energy Commission according to Title 24, which are not regulated by Title 20, installation shall be limited to those certified by the manufacturer in a declaration, executed under penalty of perjury under the laws of the State of California, that all the information provided pursuant to the certification is true, complete, accurate and in compliance with all applicable provisions of The Standards; and if applicable that the equipment, product, or device was tested under the applicable test method specified in The Standards; or

- C.** For lighting products required to be listed in directories or certified by someone other than the Energy Commission, installation shall limited to those that comply with the following provisions:

The certification status of shall be confirmed any such manufactured device shall be confirmed only by reference to:

1. A directory published or approved by the Commission; or
2. A copy of the application for certification from the manufacturer and the letter of acceptance from the Commission staff; or
3. Written confirmation from the publisher of a Commission-approved directory that a device has been certified; or

4. A Commission-approved label on the device.
- D.** The Standards does not require a builder, designer, owner, operator, or enforcing agency to test any certified device to determine its compliance with minimum specifications or efficiencies adopted by the Commission.

5.2.3 California Appliance Efficiency Regulations (Title 20)

§110.1

Any appliance regulated by the Appliance Efficiency Regulations, Title 20 California Code of Regulations, §1601 et seq., may be installed only if the appliance fully complies with those regulations. The Title 20 regulations apply to appliances that are sold or offered for sale in California, except those sold wholesale in California for final retail sale outside the state and those designed and sold exclusively for use in recreational vehicles or other mobile equipment.

Lighting products regulated by the California Appliance Efficiency Regulations (Title 20) must be certified to the Energy Commission by the manufacturer before they can be sold or offered for sale in California, or before they can be specified on California building projects subject to the Standards. The California Appliance Efficiency Regulations include requirements for both federally-regulated appliances and non-federally-regulated appliances.

5.2.4 Requirements for Lighting Control Devices and Systems, Ballasts, and Luminaires

§110.9

The Standards have minimum performance requirements for self-contained lighting control devices; field assembled lighting control systems; line-voltage track lighting integral current limiters; supplementary overcurrent protection panels for use with track lighting; ballasts for residential recessed compact fluorescent luminaires; and qualifications for residential high efficacy LED luminaires.

The requirements in §110.9 for ballasts used in residential recessed compact fluorescent luminaires, and for residential high efficacy LED luminaires, do not apply to most nonresidential lighting function areas, except for inside dwelling units of high-rise residential, hotel/motel, fire stations, and dormitory/senior housing.

A. Self-contained lighting control devices are defined by the Standards as unitary lighting control modules that require no additional components to be fully functional lighting controls. Most self-contained lighting controls required to be installed for compliance with the Standards are required to be certified by the manufacturer according to the Title 20 Appliance Efficiency Regulations. Following are types of lighting controls that are required to be certified to the Energy Commission in accordance with Title 20:

1. Time-Switch Lighting Controls

- Automatic Time-Switch Controls
 - Astronomical Time-Switch Controls
 - Multi-Level Astronomical Time-Switch Controls
 - Outdoor Astronomical Time-Switch Controls
2. Daylighting Controls
 - Automatic Daylight Controls
 - Photo Controls
 3. Dimmers
 4. Occupant Sensing Controls
 - Occupant Sensors
 - Motion Sensors
 - Vacancy Sensors

B. Requirements for Miscellaneous Lighting Controls Regulated by Title 24

Lighting controls regulated by Title 24, but not regulated by the Title 20 Appliance Efficiency Regulations, shall meet the following requirements:

1. Part-Night Outdoor Lighting Control

A Part Night Outdoor Lighting Control is defined by the Standards as a time or occupancy-based lighting control device or system that is programmed to reduce or turn off the lighting power to an outdoor luminaire for a portion of the night. (Note that this lighting control does not apply to nonresidential indoor lighting Standards).

- a. The Part-Night Outdoor Lighting Control is not required to be certified by the manufacturer to the Energy Commission.
- b. The requirements for a Part-Night Outdoor Lighting Control are as follows:
 - i. Be able to accurately predict sunrise and sunset within +/- 15 minutes and timekeeping accuracy within five minutes per year; and
 - ii. Be able to setback or turn off lighting at night as required in §130.2(c), by means of a programmable timeclock or motion sensing device; and
 - iii. When the setback or turning off is controlled with a timeclock, shall be capable of being programmed to allow the setback or turning off of the lighting to occur from any time at night until any time in the morning, as determined by the user.

2. Track lighting integral current limiter

A track lighting integral current limiter shall be recognized for compliance with the Standards only for line-voltage track lighting systems, and only if it meets all of the following requirements:

- a. Shall be certified to the Energy Commission by the manufacturer in accordance with the requirements in §110.9(c); and
- b. Before a Line-Voltage Track Lighting Integral Current Limiter will be recognized for compliance with the lighting requirements in Part 6 of Title 24, 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 Installation Certificate.
- c. If any of the requirements fail the Line-Voltage Track Lighting Integral Current Limiter installation test, the Line-Voltage Track Lighting Integral Current Limiter for determining installed lighting power shall not be used for compliance with Title 24; and
- d. Shall be manufactured so that the current limiter housing is used exclusively on the same manufacturer's track for which it is designed; and
- e. Shall be designed so that the current limiter housing is permanently attached to the track so that the system will be irreparably damaged if the current limiter housing were to be removed after installation into the track. Methods of attachment may include but are not limited to one-way barbs, rivets, and one-way screws; and
- f. Shall employ tamper resistant fasteners for the cover to the wiring compartment; and
- g. Shall have the identical volt-ampere (VA) rating of the current limiter, as the system is installed and rated for compliance with the Standards clearly marked on all of the following places:
 - i. So that it is visible for the building officials' field inspection without opening coverplates, fixtures, or panels; and
 - ii. Permanently marked on the circuit breaker; and
 - iii. On a factory-printed label that is permanently affixed to a non-removable base-plate inside the wiring compartment.
- h. Shall have a conspicuous factory installed label permanently affixed to the inside of the wiring compartment warning against removing, tampering with, rewiring, or bypassing the device; and
- i. Each electrical panel from which track lighting integral current limiters are energized shall have a factory printed label permanently affixed and prominently located, stating the following:

"NOTICE: Current limiting devices installed in track lighting integral current limiters connected to this panel shall only be replaced with the same or lower amperage. Adding track or replacement of existing current limiters with higher continuous ampere rating will void the track lighting integral current limiter certification, and will require re-submittal of compliance documentation to the enforcement agency responsible for compliance with the California Title 24, Part 6 Building Energy Efficiency Standards."

3. Track Lighting Supplementary Overcurrent Protection Panel

A Track Lighting Supplementary Overcurrent Protection Panel shall be used only for line-voltage track lighting and shall be recognized for compliance with the Standards only if it meets all of the following requirements:

- a. Before a Track Lighting Supplementary Overcurrent Protection Panel will be recognized for compliance with the lighting requirements in Part 6 of Title 24, 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 Installation Certificate.
- b. If any of the requirements in the Installation Certificate fail the installation tests, the Track Lighting Supplementary Overcurrent Protection Panel shall not be recognized by the Standards for determining installed lighting power.
- c. Shall be listed in accordance with Article 100 of the California Electric Code.
- d. Shall be used only for line voltage track lighting. No other lighting or building power shall be used in a Supplementary Overcurrent Protection Panel, and no other lighting or building power shall be recognized for compliance with the Standards by using a Supplementary Overcurrent Protection Panel
- e. Be permanently installed in an electrical equipment room, or permanently installed adjacent to the lighting panel board providing supplementary overcurrent protection for the track lighting circuits served by the supplementary over current protection pane; and
- f. Shall have a permanently installed label that is prominently located stating the following:

"NOTICE: This Panel for Track Lighting Energy Code Compliance Only. The overcurrent protection devices in this panel shall only be replaced with the same or lower amperage. No other overcurrent protective device shall be added to this panel. Adding to, or replacement of existing overcurrent protective device(s) with higher continuous ampere rating, will

void the panel listing and require re-submittal of compliance documentation to the enforcement agency responsible for compliance with the California Title 24, Part 6 Building Energy Efficiency Standards.”

C. Lighting Control Systems

Lighting Control Systems are defined by the Standards as requiring two or more components to be installed in the building to provide all of the functionality required to make up a fully functional and compliant lighting control. Lighting control systems may be installed for compliance with lighting control requirements in the Standards providing they meet all of the following requirements:

1. A lighting control system shall comply with all requirements listed below; and all components of the system considered together as installed shall meet all applicable requirements for the lighting control application for which they are installed as required in §130.0 through §130.5, §140.6 through §140.8, §141.0, and §150(k).
2. Before a Lighting Control System (including an EMCS) can be recognized for compliance with the lighting control requirements in Part 6 of Title 24, 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 an Installation Certificate.
3. If any of the requirements in the Installation Certificate fail the installation tests, the Lighting Control System (or EMCS) shall not be recognized for compliance with Title 24.
4. If there are indicator lights that are integral to a lighting control system, they shall consume no more than one watt of power per indicator light.
5. A lighting control system shall meet all of the requirements in the Title 20 Appliance Efficiency Regulations for each of the identical self-contained lighting control devices that it is installed to function as.

For example, if a lighting control system is installed to comply with the Title 24 requirements for an occupancy sensor, then the lighting control system shall comply with all of the requirements for an occupancy sensor in Title 20. If that same lighting control system is also installed to comply with the Title 24 requirements for a daylighting control, then it shall also comply with all of the requirements for a daylighting control in Title 20. Each of these functions shall be documented in the Installation Certificate (see item 2 above).

6. If the system is installed to function as a partial-on or partial-off occupant sensor, the installation may be made up of a combination of single or multi-level Occupant, Motion, or Vacancy Sensor Controls, provided that the components installed to comply with manual-on requirements shall not be capable of conversion by the user from manual-on to automatic-on functionality.

D. Requirements for Residential Luminaires.

The following requirements apply only to residential luminaires:

1. The requirements for residential luminaires apply to very few nonresidential buildings; only when installed in specifically defined residential function areas that are within a nonresidential building. (See section 5.1.1 C of this chapter)
2. Residential High Efficacy Light Emitting Diode (LED) Lighting. There are no requirements for certifying nonresidential luminaires in accordance with the Title 24 Standards. However, there are some LED luminaires and LED light engines that are designed to be installed in either residential or nonresidential applications. Following are requirements for classifying an LED luminaire as high efficacy for compliance with the residential lighting Standards:
 - a. To qualify as high efficacy for compliance with the residential lighting Standards in §150.0(k), a residential LED luminaire or LED light engine shall be certified to the Energy Commission according to the requirements in Reference Joint Appendix JA-8. LED lighting that is not certified to the Energy Commission shall be classified as low efficacy for compliance with §150.0(k), regardless of its actual efficacy.
3. Ballasts for Residential Recessed Luminaires. To qualify as high efficacy for compliance with the residential lighting Standards in §150.0(k), any compact fluorescent lamp ballast in a residential recessed luminaire shall meet all of the following conditions:
 - a. Be rated by the ballast manufacturer to have a minimum rated life of 30,000 hours when operated at or below a specified maximum case temperature. This maximum ballast case temperature specified by the ballast manufacturer shall not be exceeded when tested in accordance to UL 1598 §19.15; and
 - b. Have a ballast factor of not less than 0.90 for non-dimming ballasts and a ballast factor of not less than 0.85 for dimming ballasts.

5.3 Mandatory Classifying of Installed Luminaires and Determining Luminaire Power

§130.0(c); NA8

- A.** The requirements for classifying the type of lighting technology of a luminaire, and the requirements for determining how many watts of power is used per luminaire, are contained in §130.0(c).
1. Nonresidential Appendix NA8 provides an alternate option for determining how many watts of power is used per luminaire. NA8 provides tables that contain a limited list of lamp and ballast combinations. These tables in NA8 provide an alternate voluntary option to the provision in §130(c) for determining luminaire power for any lamp and ballast combination specifically listed in NA8. Appendix NA8 is not intended to list all possible lamp and ballast combinations, and shall not to be used to determine luminaire power for any lighting system not specifically listed in NA8. When using NA8 to determine luminaire power, luminaire classification shall still be determined in accordance with §130.0(c).
- B.** While residential luminaires are required to be classified as high or low efficacy, there are no requirements to classify nonresidential luminaires as high or low efficacy,
- C.** Following are the requirements in §130.0(c) for determining luminaire classification and power:
1. Manufacturer labeling of luminaires. Following are the requirements for labeling luminaires:
- a. The maximum relamping rated wattage of a luminaire shall be listed on a permanent, pre-printed, factory-installed label, as specified by UL 1574, 1598, 2108, or 8750, as applicable; and
- b. The factory-installed maximum relamping rated wattage label shall not consist of peel-off or peel-down layers or other methods that allow the rated wattage to be changed after the luminaire has been shipped from the manufacturer.

Peel-down labels may be used only for a luminaire meeting ALL of the following requirements:

- a. It can accommodate a range of lamp wattages without changing the luminaire housing, ballast, transformer or wiring, and
- b. It has a single lamp, and
- c. It has an integrated ballast or transformer, and
- d. Peel-down labels must be layered such that the rated wattage reduces as successive layers are removed, and

- e. The Standards will recognize peel-down labels only for the following three types of luminaires, and only when they meet all of the following conditions:
 - i. High intensity discharge luminaires, having an integral electronic ballast, with a maximum relamping rated wattage of 150 watts.
 - ii. Low-voltage luminaires (this shall 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.
2. Luminaires with line voltage lamp holders not containing permanently installed ballasts or transformers are always classified as incandescent luminaires. The wattage of such luminaires shall be determined as follows:
 - a. The maximum relamping rated wattage of the luminaire; and
 - b. For recessed luminaires with line-voltage medium screw base sockets, wattage shall not be less than 50 watts per socket.

For example, if a recessed luminaire has a relamping rated wattage on a permanent, pre-printed, factory-installed label of 30 watts, it shall be counted as 50 watts; if a recessed luminaire has a relamping rated wattage of 90 watts, it shall be counted as 90 watts.

Peel-down labels are never recognized for any type of incandescent luminaire.

3. Luminaires and luminaire housings designed to accommodate a variety of trims or modular components that allow the conversion between incandescent and any other lighting technology without changing the luminaire housing or wiring shall be classified as incandescent.
4. Screw-based adaptors shall not be used to convert an incandescent luminaire to any type of non-incandescent technology. Screw-based adaptors, including screw-base adaptors classified as permanent by the manufacturer, shall not be recognized for compliance with the Standards.
5. Luminaires and luminaire housings manufactured with incandescent screw base sockets shall be classified only as incandescent. Field modifications, including hard wiring of an LED module, shall not be recognized as converting an incandescent luminaire or luminaire housing to a non-incandescent technology for compliance with the Standards.
6. Luminaires with permanently installed or remotely installed ballasts will be either fluorescent or high intensity discharge. Wattage shall be determined as follows:
 - a. Wattage shall be the operating input wattage of the rated lamp/ballast combination published in ballast manufacturer's catalogs based on independent testing lab reports as specified by UL 1598.

- b. Replacement of lamps in a luminaire manufactured or rated for use with linear fluorescent lamps, with linear lamps of a different technology such as linear LED lamps, shall not be recognized as converting the fluorescent luminaire to a different technology for compliance with the Standards.
7. The wattage of line-voltage lighting track and plug-in busway which allows the addition or relocation of luminaires without altering the wiring of the system shall be determined by one of the following methods:

- a. There is only one option for line voltage busway and track rated for more than 20 amperes. Wattage shall be the total volt-ampere rating of the branch circuit feeding the busway and track.
- b. There are four options for determining the wattage of line voltage busway and track rated for 20 amperes or less, as follows:

- i. Line Voltage Track Lighting Option 1:

The volt-ampere rating of the branch circuit feeding the track or busway; or

- ii. Line Voltage Track Lighting Option 2

The higher of:

- The rated wattage of all of the luminaires included in the system, where luminaire classification and wattage is determined according to the applicable provisions in §130.0(c), or
- 45 watts per linear foot; or

- iii. Line Voltage Track Lighting Option 3

When using a Line-Voltage Track Lighting Integral Current Limiter, the higher of:

- The volt-ampere rating of an integral current limiter controlling the track or busway, or
- 12.5 watts per linear foot of track or busway.

An Integral current limiter shall be certified to the Energy Commission in accordance with §110.9, and shall comply with the Lighting Control Installation Requirements.

Before a Line-Voltage Track Lighting Integral Current Limiter will be recognized for compliance with the lighting requirements in Part 6 of Title 24, 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 Installation Certificate.

If any of the requirements in the Installation Certificate fail the installation tests, the Line-Voltage Track Lighting Integral Current Limiter shall not be recognized for compliance with Title 24; or

iv. Line Voltage Track Lighting Option 4

When using a dedicated track lighting supplementary overcurrent protection panel, the sum of the ampere (A) rating of all of the overcurrent protection devices times the branch circuit voltages.

Track lighting supplementary overcurrent protection panels shall comply with the applicable requirements in §110.9, and shall comply with the Lighting Control Installation Requirements.

Before a dedicated track lighting supplementary overcurrent protection panel will be recognized for compliance with the lighting requirements in Part 6 of Title 24, 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 Installation Certificate.

If any of the requirements in the Installation Certificate fail the installation tests, the track lighting supplementary overcurrent protection panel shall not be recognized for compliance with Title 24

8. Luminaires and lighting systems with permanently installed or remotely installed transformers. The wattage of such luminaires shall be determined as follows:
 - a. For low-voltage luminaires that do not allow the addition of lamps, lamp holders, or luminaires without rewiring, the wattage shall be the rated wattage of the lamp/transformer combination.
 - b. For low-voltage lighting systems, including low voltage tracks and other low-voltage lighting systems which allow the addition of lamps, lamp holders, or luminaires without rewiring, the wattage shall be the maximum rated input wattage of the transformer, labeled in accordance with item 1, or the maximum rated wattage published in transformer manufacturer's catalogs, as specified by UL 2108.
9. Light emitting diode (LED) Luminaires, and LED Light Engine for nonresidential applications are not required to be certified to the Energy Commission. LED luminaires and light engines for residential applications shall be certified to the Energy Commission in order to be classified as high efficacy. See Chapter 5 in the 2013 Residential Compliance Manual for information on classifying residential LED luminaires as high efficacy.
 - a. The wattage of such luminaires shall be the maximum rated input wattage of the system when tested in accordance with IES LM-79-08.
 - b. The maximum rated input wattage shall be labeled on the luminaire, light engine, or luminaire housing in accordance with §130.0(c)1. Labels only

- on the power supply are not sufficient for compliance with this requirement.
- c. An LED lamp, integrated or non-integrated type in accordance with the definition in ANSI/IES RP-16-2010, shall not be classified as a LED lighting system for compliance with The Standards. LED modules having screw-bases including screw based pig-tails, screw-based sockets, or screw-based adaptors shall not be recognized as a LED lighting system for compliance with The Standards.
 - d. Luminaires and luminaire housings equipped with screw-base sockets shall not be classified as a LED lighting system for compliance with The Standards.
 - e. Luminaires manufactured or rated for use with low-voltage incandescent lamps, into which have been installed LED modules or LED lamps, shall not be recognized as a LED lighting system for compliance with the Standards.
 - f. For LED lighting systems which allow the addition of luminaires or light engines without rewiring, the wattage of such luminaires shall be the maximum rated input wattage of the power supply, labeled in accordance with §130.0(c)1 or published in the power supply manufacturer's catalog.
10. The wattage of all other miscellaneous lighting equipment shall be the maximum rated wattage of the lighting equipment, or operating input wattage of the system, labeled in accordance with §130.0(c)1, or published in manufacturer's catalogs, based on independent testing lab reports as specified by UL 1574 or UL 1598. Lighting technologies listed in subsections 2 through 9 shall be determined in accordance with the applicable requirements in subsections 1 through 9.

5.4 Mandatory Lighting Controls

§130.1

The installation of lighting controls are mandatory measures. This section contains information about lighting controls that shall be installed, regardless of the method used to comply with the lighting power requirements.

- A. All lighting controls and equipment shall comply with the applicable requirements in §110.9, and shall be installed in accordance with the manufacturer's instructions (§130.0(d)).
- B. Mandatory nonresidential indoor lighting controls include the following:
 - 1. Area Controls. Manual controls separately controlling lighting in each area.
 - 2. Multi-Level Controls. Providing occupants with the ability to use all of the light, some of the light, or none of the light in an area.
 - 3. Shutoff Controls. Automatically shutting off lighting when it is not needed.
 - 4. Daylighting Controls. Separately controlling some or all of the lights in the daylight area from the lights that are not in the daylight area.
 - 5. Demand Responsive Lighting Controls. Installing controls that are capable of receiving and automatically responding to a demand response signal.

5.4.1 Area Lighting Controls.

§130.1(a)

- A. All luminaires in each area enclosed by ceiling-height partitions shall be independently controlled from luminaires in other areas, with fully functional manual ON and OFF lighting controls.

EXCEPTION: The exception to the mandatory area lighting control requirements is that up to 0.2 watts per square foot of lighting in any area within a building may be continuously illuminated during occupied times to allow for emergency egress, provided that the following conditions are met:

- 1. The area is designated an emergency egress area on the building plans and specifications submitted to the enforcement agency under §10-103(a)2 of Part 1; and
 - 2. The control switches for the egress lighting are not accessible to unauthorized personnel.
- B. The ON and OFF lighting controls shall meet the following requirements:
 - 1. Be readily accessible to occupants; and
 - 2. Be operated with a manual switch that is located in the same room or area with the lighting that is being controlled by that lighting control; and
 - 3. If controlling dimmable luminaires, be a dimmer switch that allows manual ON and OFF functionality, and is capable of manually controlling lighting through all multi-level lighting control steps that are required in §130.1(b).

EXCEPTIONS: There are two exceptions to the requirements for these controls to be readily accessible and located in the same room:

- a. In malls, auditoriums, retail and wholesale sales floors, industrial facilities, convention centers, and arenas, the lighting control shall be located so that a person using the lighting control can see the lights or area controlled by that lighting control, or so that the lighting control for the area is annunciated.

Annunciated is defined in the Standards as a type of visual signaling device that indicates the on, off, or other status of a load.

- b. Public restrooms having two or more stalls may use a manual switch that is not accessible to unauthorized personnel. However, all other lighting controls in accordance with §130.1 are still required.

C. Interaction of Manual ON and OFF Switches with Other Lighting Controls.

1. In addition to the manual area lighting controls, other lighting controls may be installed provided they do not override the functionality of controls installed in accordance with §130.1(a)1 (functionally controlled with a manual switch), §130.1(a)2 (readily accessible), or §130.1(a)4 (separately controlled lighting systems).

D. Separately Controlled Lighting Systems.

In addition to the requirements in §130.1(a)1, 2, and 3:

1. General lighting shall be separately controlled from all other lighting systems in an area.
2. Floor and wall display, window display, case display, ornamental, and special effects lighting shall each be separately controlled on circuits that are 20 amps or less.
3. When track lighting is used, general, display, ornamental, and special effects lighting shall each be separately controlled.

5.4.2 Multi-Level Lighting Controls.

§130.1(b)

- A.** The multi-level lighting control requirements allow a room to be occupied with all of the lights turned on, part of the lights turned on, and none of the lights turned on, whether the room is occupied or not. The number of required lighting control steps varies, depending on the type of lighting technology in each installed luminaire, in accordance with Table 5-1.
- B.** The general lighting of any room 100 square feet or larger, with a connected lighting load that exceeds 0.5 watts per square foot shall meet the following requirements:
 1. Lighting shall have the required number of control steps and meet the uniformity requirements in accordance with TABLE 5-1; and

2. Multi-level lighting controls shall not override the functionality of other lighting controls required for compliance with Sections 130.1(a), and (c) through (e); and
3. In addition to the multi-level lighting controls required in Table 5-1, each luminaire shall be controlled by at least one of the methods listed below.
 - a. Manual dimming installed to meet the requirements of §130.1(a)
 - b. Lumen maintenance, defined in the Standards as a strategy used to provide a precise, constant level of lighting from a lighting system regardless of the age of the lamps or the maintenance of the luminaires.
 - c. Tuning, defined in the Standards as the ability to set maximum light levels at a lower level than full lighting power.
 - d. Automatic daylighting control installed to meet the requirements in §130.1(d)
 - e. Demand responsive lighting controls installed to comply with §130.1(e)

NOTE: Some of the controls listed above may be installed to comply with other lighting control requirements in §130.1.

C. EXCEPTIONS to multi-level lighting controls

The following applications are not required to comply with the requirements in Table 5-1:

1. Classrooms, with a connected general lighting load of 0.7 watts per square feet and less, instead of meeting the multi-level lighting control steps required in Table 5-1, shall have at least one control step between 30-70 percent of full rated power.
2. An area enclosed by ceiling height partitions that has only one luminaire with no more than two lamps.

**TABLE 5- 1- (Table 130.1-A in the Standards)
Multi-Level Lighting Controls and Uniformity Requirements**

Luminaire Type	Minimum Required Control Steps (percent of full rated power ¹)				Uniform level of illuminance shall be achieved by:
Line-voltage sockets except GU-24 Low-voltage incandescent systems LED luminaires and LED source systems GU-24 rated for LED	Continuous dimming 10-100 percent				
GU-24 sockets rated for fluorescent > 20 watts Pin-based compact fluorescent > 20 watts ²	Continuous dimming 20-100 percent				
GU-24 sockets rated for fluorescent ≤ 20 watts Pin-based compact fluorescent ≤ 20 watts ² Linear fluorescent and U-bent fluorescent ≤ 13 watts	Minimum one step between 30-70 percent				<ul style="list-style-type: none"> • Stepped dimming; or • Continuous dimming; or • Switching alternate lamps in a luminaire
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range:				<ul style="list-style-type: none"> • Stepped dimming; or • Continuous dimming; or • Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire, illuminating the same area and in the same manner
	20% to 40%	50% to 70%	80% to 85%	100%	
Track Lighting	Minimum one step between 30 – 70 percent				<ul style="list-style-type: none"> • Step dimming; or • Continuous dimming; or • Separately switching circuits in multi-circuit track with a minimum of two circuits.
HID > 20 watts Induction > 25 watts	Minimum one step between 50 - 70 percent				<ul style="list-style-type: none"> • 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.
Other light sources					
<p>1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor 2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps</p>					

5.4.3 Automatic Shut-OFF Controls

§130.1(c)

A. In addition to lighting controls installed to comply with §130.1(a)(manual ON and OFF switches located in each room); §130.1(b)(multi-level lighting controls); §130.1(d)(daylighting controls); and §130.1(e)(demand responsive controls) - all installed indoor lighting shall be equipped with controls that meet the following requirements:

1. Shall be controlled with one or more of the following automatic shut-OFF controls when the space is typically unoccupied:
 - a. Occupant sensing control
 - b. Automatic time-switch control
 - c. Signal from another building system
 - d. Other control capable of automatically shutting OFF all of the lights; and
2. Separately controls for the lighting on each floor; and
3. Separately controls a space enclosed by ceiling height partitions, which does not exceed 5,000 square feet per separately controlled space; and

EXCEPTION: Only in the following function areas, the separately controlled space may exceed 5,000 square feet, but may not exceed 20,000 square feet per separately controlled space, and separately controls the lighting on each floor:

- a. Mall
 - b. Auditorium
 - c. Single tenant retail
 - d. Industrial
 - e. Convention center
 - f. Arena
4. Separately controls the general, display, ornamental, and display case lighting.

B. EXCEPTIONS to §130.1(c)1:

The following applications are not required to be controlled with automatic shut-OFF requirements in accordance with §130.1(c)1:

1. Where the lighting is serving an area that is in continuous use, 24 hours per day/365 days per year.
2. Lighting complying with §130.1(c)5 instead of §130.1(c)1
 This exception only applies to those areas where occupant sensing controls are required to shut OFF all lighting in offices 250 square feet or smaller, multipurpose rooms of less than 1,000 square feet, classrooms of any size, or conference rooms of any size, in accordance with §130.1(c)5.
3. Lighting complying with §130.1(c)7 instead of §130.1(c)1
 This exception applies only to those areas where partial ON/OFF occupant sensing controls are required in stairwells and common area corridors with provide access to guestrooms and dwelling units in accordance with

§130.1(c)7A; or parking garages in accordance with §130.1(c)7B; instead of complying with §130.1(c)1

4. Only in office buildings, up to 0.05 watts per square foot of lighting in any area within a building may be continuously illuminated, provided that the area is designated an emergency egress area on the plans and specifications submitted to the enforcement agency under §10-103(a)2 of Part 1.
5. Electrical equipment rooms subject to Article 110.26(D) of the California Electric Code.

- C.** Countdown timer switches shall not be used to comply with the automatic shut-OFF control requirements in §130.1(c)1.

EXCEPTIONS: Only the following three function areas may use a countdown timer switch to comply with the automatic shut-OFF control requirements

1. Single-stall bathrooms smaller than 70 square feet may use countdown timer switches with a maximum setting capability of ten minutes.
2. Closets smaller than 70 square feet may use countdown timer switches with a maximum setting capability of ten minutes.
3. Lighting in a Server Aisle in a Server Room may use countdown timer switches with a maximum setting capability of 30 minutes.
 - a. *A Server Aisle is defined by the Standards as an aisle of racks of Information Technology (IT) server equipment in a Server Room. While networking equipment may also be housed on these racks, it is largely a room to manage server equipment.*
 - b. *A Server Room is defined by the Standards as a room smaller than 500 square feet, within a larger building, in which networking equipment and Information Technology (IT) server equipment is housed, and a minimum of five IT servers are installed in frame racks.*

- D.** When an occupant sensing control is used to comply with the automatic shut-OFF requirements, the lights are automatically controlled in response to the presence or absence of occupants. However, when an automatic time-switch control is used to comply with the automatic shut-OFF requirements, such a control is not responsive to the presence or absence of occupants. Therefore, when any control other than an occupant sensing control is used (i.e.: automatic time-switch control, signal from another building system, or other control capable of automatically shutting OFF all of the lights), the lighting control system shall incorporate an override lighting control that:

1. Complies with §130.1(a) (Manual ON/OFF switch located in each room); and
2. Allows the lighting to remain ON for no more than 2 hours when an override is initiated.

EXCEPTIONS: In the following function areas, only when a captive-key override is utilized, the override time may exceed 2 hours:

- a. Malls
- b. Auditoriums
- c. Single tenant retail
- d. Industrial

e. Arenas.

- E.** If an automatic time-switch control, other than an occupant sensing control, is installed to comply with §130.1(c)1, it shall incorporate an automatic holiday "shut-OFF" feature that turns OFF all loads for at least 24 hours, and then resumes the normally scheduled operation.

EXCEPTIONS: In only the following function areas, the automatic time-switch control is not required to incorporate an automatic holiday shut-OFF feature:

1. Retail stores and associated malls
2. Restaurants
3. Grocery stores
4. Churches
5. Theaters

- F.** Areas where Occupant Sensing Controls are required to shut OFF ALL Lighting.

§130.1(c)5

1. Lighting in the following function areas shall be controlled with occupant sensing controls to automatically shut OFF all of the lighting when the room 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 square feet or smaller
 - b. Multipurpose rooms of less than 1,000 square feet
 - c. Classrooms of any size
 - d. Conference rooms of any size

- G.** Areas where partial ON/OFF occupant sensing controls are required in addition to complying with §130.1(c)1.

§130.1(c)6

1. In aisle ways 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 shall independently control lighting in each aisle way, and shall not control lighting beyond the aisle way being controlled by the sensor.

EXCEPTIONS: The following spaces are not required to be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied, provided they also meet the following requirements:

- a. 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.

- b. 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.

Note that the portion of lighting that is not controlled to reduce the lighting, in accordance with item (a) above, is still required to comply with the applicable automatic shut-OFF controls in §130.1(c).

2. In library book stack aisles meeting the following criteria, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied:
 - a. Library book stack aisles 10 feet or longer that are accessible from only one end; and
 - b. 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.

Note that the portion of lighting that is not controlled to reduce the lighting, in accordance with item (b) above, is still required to comply with the applicable automatic shut-OFF controls in §130.1(c).

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

H. Areas where partial ON/OFF occupant sensing controls are required instead of complying with §130.1(c)1.

§130.1(c)7

1. Lighting in stairwells and common area corridors which provide access to guestrooms and dwelling units of high-rise residential buildings and 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.

EXCEPTION: In 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.

2. In parking garages, parking areas and loading and unloading areas, the general lighting shall be controlled as follows:
 - a. By occupant sensing controls having at least one control step between 20 percent and 50 percent of design lighting power, and
 - b. No more than 500 watts of rated lighting power shall be controlled together as a single zone, and

- c. A reasonably uniform level of illuminance shall be achieved in accordance with the applicable requirements in TABLE 5-1, and
- d. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and
- e. The occupant sensing controls shall be automatically activated from all designed paths of egress.

EXCEPTION: Metal halide luminaires meeting 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:

- Have a metal halide lamp plus ballast mean system efficacy of greater than 75 lumens per watt, and
- Are used for general lighting in parking garages, parking areas and loading and unloading areas.

Note that interior areas of parking garages are classified as indoor lighting for compliance with §130.1(c)7B. Parking areas on the roof of a parking structure are classified as outdoor hardscape and shall comply with the applicable provisions in §130.2.

I. Hotel and Motel Guest Rooms

§130.1(c)8

In addition to complying with the residential lighting Standards in accordance with §130.0(b), hotel and motel guest rooms shall have captive card key controls, occupancy sensing controls, or automatic controls such that, no longer than 30 minutes after the guest room has been vacated, lighting power is switched off.

EXCEPTION: A luminaire in a hotel or motel guest room meeting all of the following criteria is not required to have captive card key controls, occupancy sensing controls, or automatic controls.

- Applies to one high efficacy luminaire (where high efficacy is defined in TABLE 150.0-A or 150.0-B), and
- That is switched separately from the other lighting in the room, and
- The switch for that luminaire is located within 6 feet of the entry door.

However, the luminaire meeting the exception above is still required to comply with the applicable residential lighting Standards in accordance with §130.0(b).

5.4.4 Mandatory 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. §130.1(d) address mandatory requirements for daylighting.

Additional lighting controls are required in daylit zones to automatically shut off lighting when sufficient daylight is available.

Prescriptive daylighting controls are covered in section 5.5 of this chapter.

A. Description of Terms

The following terms are used to describe the daylighting requirements in §130.1(d).

1. *General Lighting is defined by the Standards as installed electric lighting that provide a uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect, exclusive of daylighting, and also know as ambient light.*
2. Window Head Height

The vertical distance from the finished floor level to the top of a window.

3. Daylit Zones

A region of space considered to be close enough to a source of daylight such as window, clerestory, roof monitor or skylight, where luminaires can be dimmed or switched in response to available daylight.

B. Definitions of Daylit Zones

Areas having skylights and window are classified according to daylit zones. The three different types of Daylit Zones are defined as follows:

1. *SKYLIT DAYLIT ZONE is the rough area in building 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 the following:*
 - a. *A permanent obstruction that is taller than one-half the distance from the floor to the bottom of the skylight.*

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 the purpose of 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, for a rectangular skylight the skylit daylit zone plan area shall be rectangular, and for a circular skylight the skylit daylit zone plan area shall be circular.

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

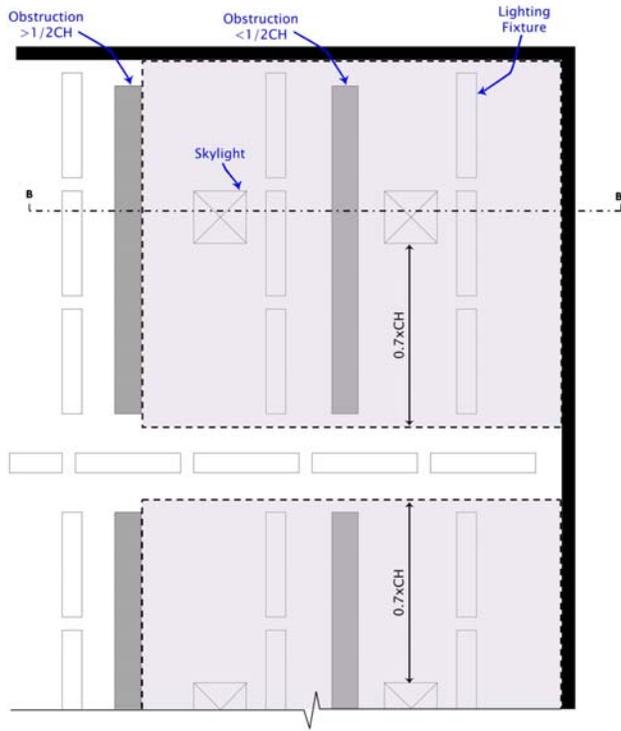


Figure 5-3 – Skylit Daylit Zone Diagram 1

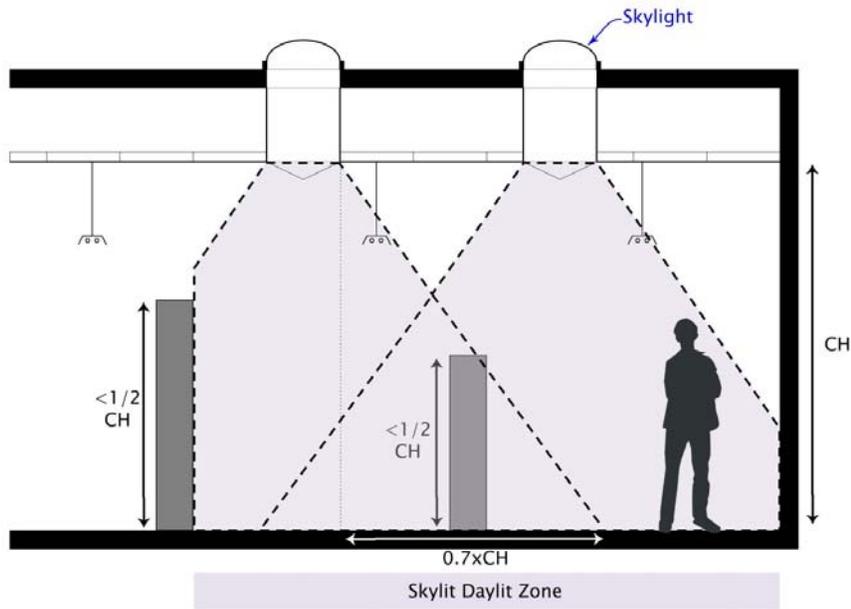


Figure 5-4 – Skylit Daylit Zone Diagram 2

2. *PRIMARY SIDELIT DAYLIT ZONE* is the area on a building plan 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 shall not be considered a permanent obstruction.

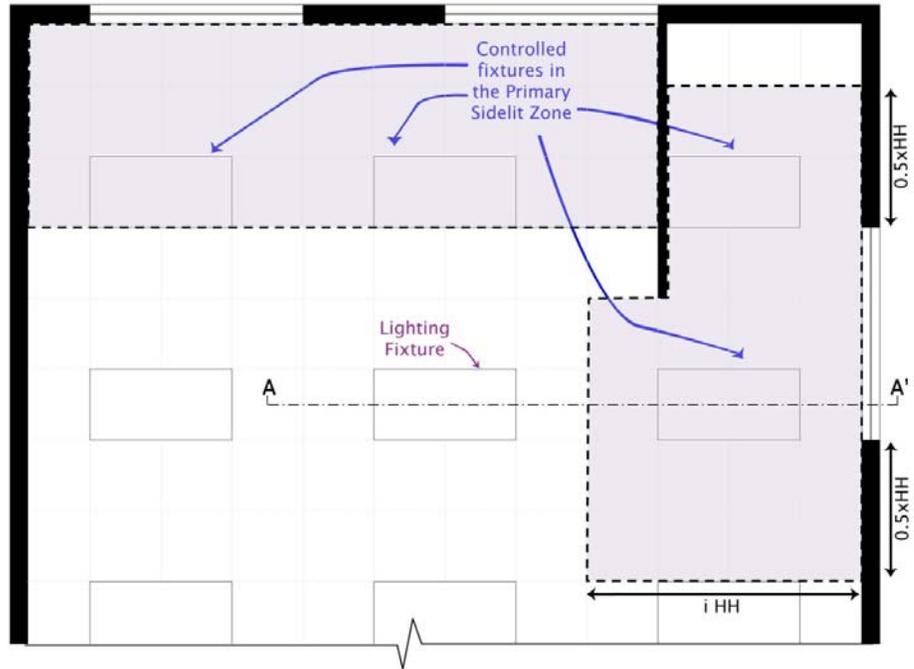


Figure 5-5 – Primary Sidelit Daylit Zone Diagram 1

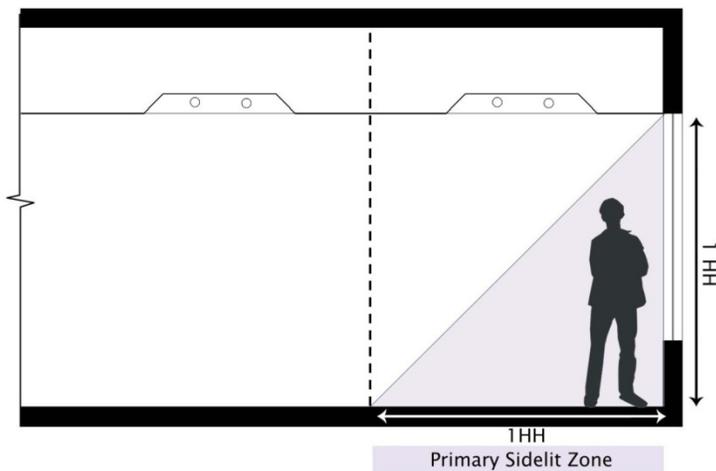


Figure 5-6 – Primary Sidelit Daylit Zone Diagram 1

3. **SECONDARY SIDELIT DAYLIT ZONE** is the area on a plan 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 shall not be considered a permanent obstruction.

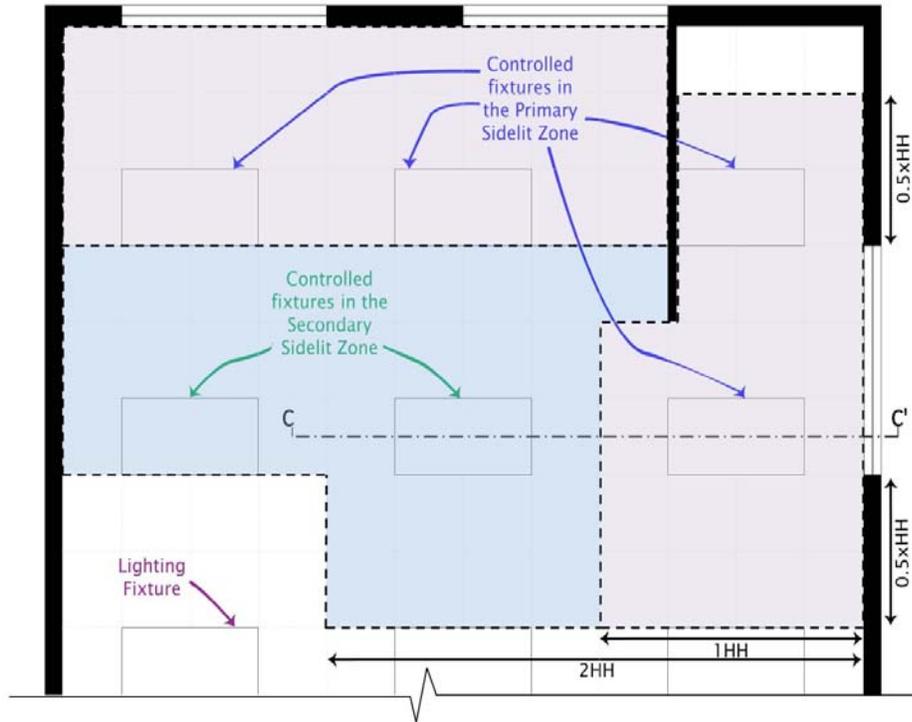


Figure 5-7 – Secondary Sidelit Daylit Zone Diagram 2

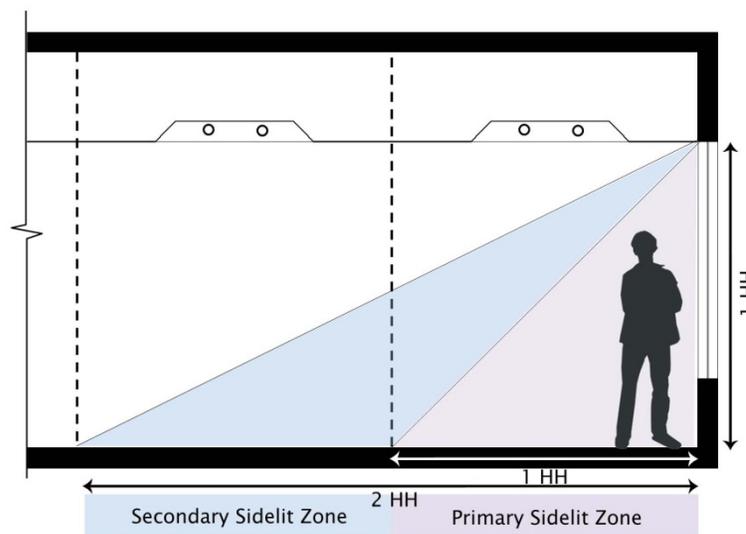


Figure 5-8 – Secondary Sidelit Daylit Zone Diagram 2

C. Controlling Lighting in Daylit Zones

1. There are mandatory controls required for lighting in Skylit Daylit Zones and Primary Sidelit Daylit Zones. The mandatory daylighting controls are covered in this section.

There are also prescriptive controls required for lighting in Secondary Sidelit Daylit Zones. The prescriptive daylighting controls are covered in section 5.5 of this chapter.

2. Mandatory daylighting controls are required in the following daylit zones:

Luminaires providing general lighting that are in, or are partially in, the Skylit Daylit Zones or the Primary Sidelit Daylit Zones shall be controlled independently by fully functional automatic daylighting controls that meet the applicable device requirements in §110.9, and meet the applicable requirements below:

- a. All Skylit Daylit Zones and Primary Sidelit Daylit Zones shall be shown on the building plans.
- b. Luminaires in the Skylit Daylit Zone shall be controlled separately from those in the Primary Sidelit Daylit Zones.
- c. Luminaires that fall in both a Skylit and Primary Sidelit Daylit Zone shall be controlled as part of the Skylit Daylit Zone.

There are also prescriptive daylighting control requirements, which are covered in section 5.5 of this chapter.

3. Automatic Daylighting Control Installation and Operation

For luminaires in Skylit Daylit Zones and Primary Sidelit Daylit Zones, automatic daylighting controls shall be installed and configured to operate according to all of the following requirements:

- a. Photosensors shall be located so that they are not readily accessible to unauthorized personnel, and the location where calibration adjustments are made to automatic daylighting controls shall not be readily accessible to unauthorized personnel.
- b. Automatic daylighting controls shall provide functional multi-level lighting levels having at least the number of control steps specified in TABLE 5-1.
EXCEPTIONS: Multi-level lighting daylight controls are not required as follows:
 - i. Controlled lighting having a lighting power density less than 0.3 W/ft²
 - ii. When skylights are replaced or added to an existing building where there is an existing general lighting system that is not being altered.
- c. 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.
- d. In areas served by lighting that is daylight controlled, when the illuminance received from the daylight is greater than 150 percent of the design

illuminance received from the general lighting system at full power, the general lighting power in that daylight zone shall be reduced by a minimum of 65 percent.

EXCEPTIONS:

- i. Rooms in which the combined total installed general lighting power in the Skylit Daylit Zone and Primary Sidelit Daylit Zone is less than 120 Watts.
- ii. Rooms which have a total glazing area of less than 24 square feet.
- iii. Parking garages complying with §130.1(d)3.

4. Parking Garage Daylighting Requirements.

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 by automatic daylighting controls, and shall meet the following requirements as applicable:

- a. All primary and secondary sidelit daylit zones shall be shown on the building plans.
- b. Automatic Daylighting Control Installation and Operation.

Automatic daylighting control shall be installed and configured to operate according to all of the following requirements:

- i. Automatic daylighting controls shall have photosensors that are located so that they are not readily accessible to unauthorized personnel, and the location where calibration adjustments are made to the automatic daylighting controls shall not be readily accessible to unauthorized personnel.
- ii. Automatic daylighting controls shall be multi-level, continuous dimming or ON/OFF.
- iii. The combined illuminance from the controlled lighting and daylight shall not be less than the illuminance from controlled lighting when no daylight is available.
- iv. When primary sidelit zones receive illuminance levels greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power consumption shall be zero.

EXCEPTIONS:

- Luminaires located in the daylight transition zone and luminaires for only dedicated ramps. Daylight transition zone and dedicated ramps are defined in §100.1.
- When the total combined general lighting power in the primary sidelit daylight zones is less than 60 watts.

Examples for complying with the mandatory daylighting controls requirements, and the prescriptive daylighting requirements are covered in section 5.5 of this chapter.

5.4.5 Demand Responsive Controls.

1. Lighting power in buildings larger than 10,000 square feet shall be capable of being automatically reduced in response to a Demand Responsive Signal; so that the building's total lighting power can be lowered by a minimum of 15 percent below the total installed lighting power. Lighting shall be reduced in a manner consistent with uniform level of illumination requirements in TABLE 5-1.
2. Spaces that are non-habitable shall not be used to comply with this requirement, and spaces with a sum total lighting power density of less than 0.5 watts per square foot shall not be counted toward the building's total lighting power.

3. Demand Response Definitions:

- a. *DEMAND RESPONSE is defined as short-term changes in electricity usage by end-use customers, from their normal consumption patterns.*

Demand response may be in response to:

- i. *Changes in the price of electricity; or*
- ii. *Participation in programs or services designed to modify electricity use in response to wholesale market prices or when system reliability is jeopardized.*
- b. *DEMAND RESPONSE PERIOD is defined as a period of time during which electricity loads are modified in response to a demand response signal.*
- c. *DEMAND RESPONSE SIGNAL is defined as a signal sent by the local utility, Independent System Operator (ISO), or designated curtailment service provider or aggregator, to a customer, indicating a price or a request to modify electricity consumption, for a limited time period.*
- d. *DEMAND RESPONSIVE CONTROL is defined as a kind of control that is capable of receiving and automatically responding to a demand response signal.*

4. Demand responsive controls and equipment

Demand responsive controls and equipment shall be capable of receiving and automatically responding to at least one standards based messaging protocol which enables demand response after receiving a demand response signal.

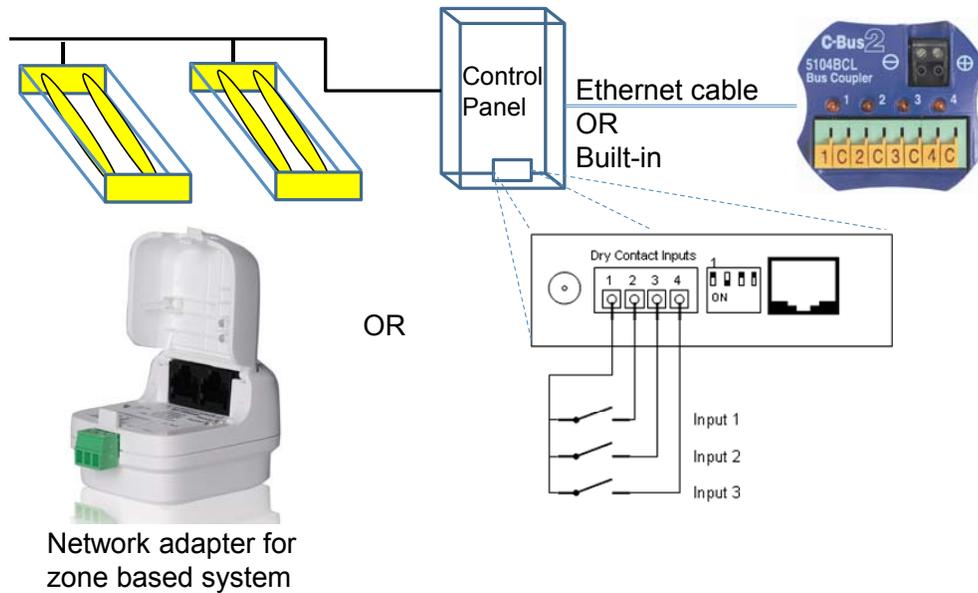


Figure 5-3 - Potential inputs to receive Demand Response signal

Figure 5-3 This figure illustrates example inputs that could be used to receive demand response signals. The inclusion of one of these types of control inputs, along with the proper design of the lighting system, will result in a lighting system that complies with the requirements of §130.1(e). There are several ways in which the lighting can be designed to meet the demand responsive requirements; outlined below are three specific compliance scenarios.

Example 5-1 Centralized Powerline Dimming Control

This scenario uses a system that has centralized control of dimmable ballasts using a type of powerline carrier signal. This requires no additional wiring as the control signal travels over the existing power line. This can be a very effective means of enabling demand response in small scenarios, such as a small office. This requires the use of a lighting control panel downstream of the breaker panel. The lighting circuit relays are replaced by circuit controllers, which can send the dimming signal via line voltage wires. The panel could have several dry contact inputs that provide dedicated levels of load shed depending upon the demand response signal received. Different channels can be assigned to have different levels of dimming as part of the demand response. Local controls can be provided by either line voltage or low voltage controls.

Example 5-2 Addressable Lighting System

The addressable lighting system is similar in design to that of a centralized control panel, but with additional granularity of control. With an addressable system, each fixture can be addressed individually, whereas a centralized control panel is limited to an entire channel, or circuit, being controlled in unison. The cost of enabling demand response on a system with a centralized control panel is less dependent on building size or number of rooms than a zone based system.

Enabling demand response for the addressable lighting system entails making a dry contact input available to receive an electronic signal. This is a feature that is included in the base model of most lighting control panels. Some smaller scale addressable lighting systems may have a limited number of inputs dedicated for alternative uses, such as a timeclock. If this is the case, an I/O input device can be added to the network to provide an additional closed contact input.

Example 5-3 Demand response for select zones

Enabling demand response for a zoned system would entail adding a network adapter to each room to be controlled for purposes of demand response. The network adapter allows for each room to be monitored and controlled by an energy management control system (EMCS). These types of systems are commonly used for HVAC systems, and to respond to demand response signals. The assumption is that if the building is installing an EMCS, the preference would be to add the lighting network to that existing demand response system. There is additional functionality that results from adding the lighting system to an EMCS. In addition to being able to control the lighting for demand response, the status of the lighting system can then be monitored by the EMCS. For example, occupancy sensors would be able to be used as triggers for the HVAC system, turning A/C on and off when people entered and left the room. Therefore the potential for savings from this type of system is higher than the value of the lighting load shed for demand response.

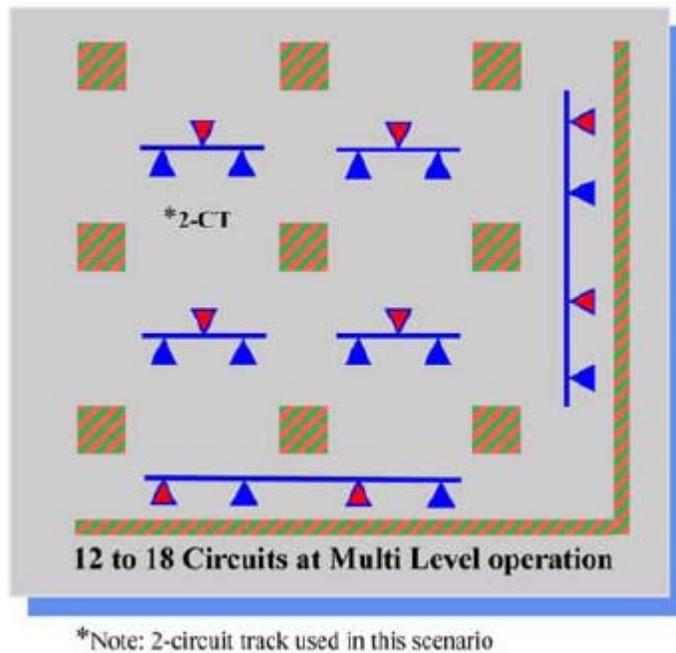


Figure 5-4 – Sample retail DR (demand response) control strategy

Figure 5-4 illustrates a sample demand response design that maintains uniformity and with a 25 percent power reduction exceeds the 15 percent minimum power reduction requirement. The triangles in this plan are halogen display lighting – the triangles with colored centers are turned off during the DR period. The striped squares are fluorescent troffers and the striped lines

are fluorescent wall washers. These fluorescent fixtures are wired for bi-level control so that half of the lamps are turned off during the DR period.

5.4.6 Lighting Control Acceptance Requirements

Before an occupancy permit shall be granted for a newly constructed building or area, or a new lighting system serving a building, area, or site is operated for normal use, indoor and outdoor lighting controls serving the building, area, or site shall be certified as meeting the Acceptance Requirements for Code Compliance in accordance with §130.4.

A Certificate of Acceptance shall be submitted to the enforcement agency under §10-103(a) of Part 1, that:

- A.** Certifies that the plans, specifications, installation certificates, and operating and maintenance information meet the requirements of Part 6.
- B.** Completes the applicable procedures in Reference Nonresidential Appendix NA7.6, NA7.7, NA7.8, and NA7.9; and submits all applicable compliance forms.
- C.** Certifies that automatic daylight controls comply with §130.1(d) and Reference Nonresidential Appendix NA7.6.1
- D.** Certifies that lighting shut-OFF controls comply with §130.1(c) and Reference Nonresidential Appendix NA7.6.2
- E.** Certifies that demand responsive controls comply with §130.1(e) and Reference Nonresidential Appendix NA7.6.3
- F.** Certifies that outdoor lighting controls comply with the applicable requirements of §130.2(c) and Reference Nonresidential Appendix NA7.8.

5.4.7 Lighting Installation Certificate Requirements

- A.** Before any of the following applications will be recognized for compliance with the lighting requirements in Part 6 of Title 24, 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 Installation Certificate:
 - 1. Lighting Control System
 - 2. Energy Management Control System
 - 3. Track lighting integral current limiter
 - 4. Track lighting supplementary overcurrent protection panel
 - 5. Two interlocked lighting system service a single space
 - 6. A Lighting Power Adjustment Factor
 - 7. Additional wattage available for a videoconference studio

- B.** If any of the requirements in the Installation Certificate fail the installation tests, that application shall not be recognized for compliance with Part 6 of Title 24.

5.5 Daylighting Requirements

This section contains information about the prescriptive nonresidential indoor daylighting control requirements, and minimum daylighting requirements for large enclosed spaces.

The prescriptive daylighting requirements are in addition to the mandatory daylighting controls, which are covered in section 5.4.4 of this chapter.

The end of this section also has examples for complying with the mandatory daylighting requirements.

5.5.1 Prescriptive Daylighting Control Requirements

§140.6(d)

A. Automatic Daylighting Controls in Secondary Daylit Zones.

All luminaires providing general lighting that is in, or partially in a Secondary Sidelit Daylit Zone as defined in Section 130.1(d)1C (see section 5.4.4 B3 of this chapter), and that is not in a Primary Sidelit Daylit Zone shall comply with the following:

1. The general lighting shall be controlled independently from all other luminaires by automatic daylighting controls that meet the applicable requirements of Section 110.9; and
2. The general lighting shall be controlled in accordance with the applicable requirements in Section 130.1(d)2 (see section 5.4.2 of this chapter); and
3. All Secondary Sidelit Daylit Zones shall be shown on the plans submitted to the enforcing agency.
4. EXCEPTIONS:
5. Luminaires in Secondary Sidelit Daylit Zone(s) in areas where the total wattage of general lighting is less than 120 Watts.
6. Luminaires in parking garages complying with Section 130.1(d)3.

5.5.2 Minimum Daylighting Requirements for Large Enclosed Spaces

§140.3(c)

- A. Section 140.3 of the Standards has prescriptive requirements for building envelopes, including minimum daylighting for large enclosed spaces. Lighting installed in spaces complying with these prescriptive envelope measures are also required to comply with all lighting control requirements, including the mandatory and prescriptive lighting control requirements.

The mandatory daylighting control requirements are covered in section 5.4.4 of this chapter. The prescriptive daylighting control requirements are covered directly above in section 5.5.1 of this chapter.

B. Spaces Requiring Minimum Daylighting:

The minimum prescriptive daylighting requirements for large enclosed spaces applies to both conditioned and unconditioned nonresidential spaces that meet the following qualifying criteria and are not exempted per the following exemptions:

1. Qualifying Criteria:
 - a. Space is directly under a roof
 - b. Is located in one of the climate zones 2 through 15
 - c. Has a floor area greater than 5,000 ft²
 - d. Has a ceiling height greater than 15 ft
2. Exemptions:
 - a. Spaces having a general lighting system with a power density less than 0.5 W/ft², or
 - b. Is a function area, as defined in §100.1, which is one of the following: Auditoriums, churches, movie theaters, museums, or refrigerated warehouses.
3. Additional Exemptions: In buildings with unfinished interiors, future enclosed spaces are exempt which are planned to have:
 - a. A floor area less than or equal to 5,000 ft², or
 - 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.

However, if the final building has a floor area greater than 5,000 ft², or ceiling heights greater than 5 feet, then the minimum prescriptive daylighting for large enclosed spaces shall be required.

C. The Prescriptive Daylighting Requirements:

1. For large enclosed spaces that are required to comply, following are the minimum prescriptive daylighting requirements:
 - a. At least 75 percent of the total space floor area shall be under Skylit Daylight Zone or Primary Sidelit Daylit Zone, shown on the plans
 - b. General lighting in daylit zones shall be controlled in accordance with §130.1(d).
 - c. Skylights shall have a glazing material or diffuser that has a measured haze value greater than 90 percent, tested according to ASTM D1003.

Example 5-1

Methods for complying with the mandatory daylight control requirements for a space with linear fluorescent luminaires

The Standards require that automatic daylighting controls shall provide functional multi-level lighting levels having at least the number of control steps specified in TABLE 5-1 (Table 130.1-A in the Standards). A minimum of 4 control steps are needed. These steps are identified as:

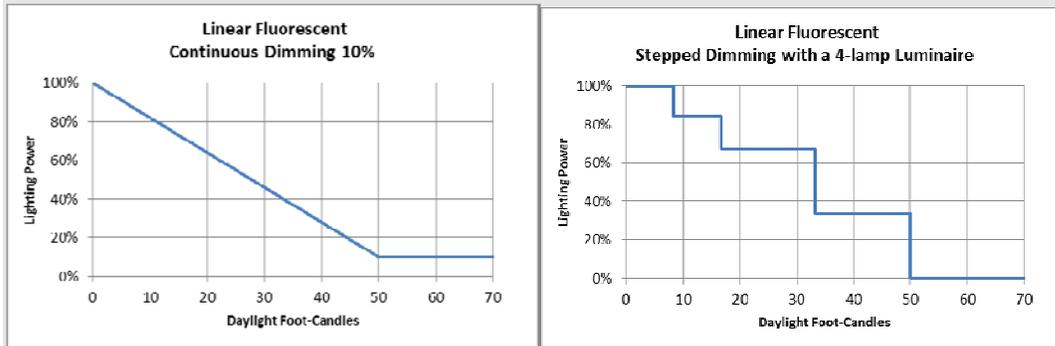
- 1 - 20-40%; 2 - 50-70%; 3 - 80-85%; 4 - 100%

This can be achieved in one of three ways, using:

- A. Continuous dimming - Here the photocontrol gradually dims all luminaires in the daylit zone in response to the available daylight.
- B. Stepped dimming with a 4-lamp luminaire - The required control steps can be achieved using a 4-lamp fixture and with two lamps powered by an ON/OFF

Stage	On/Off Switching Ballast - power level	2-Stepped Dimming Ballast - power level	Result
1 - Full ON	100%	100%	100%
2	100%	67%	84%
3	100%	33%	67%
4	0%	67%	34%
5 - Full OFF	0%	0%	0%

- C. Switching alternate lamps in each luminaire, having a minimum of 5 lamps per luminaire. Here the lamps may be tandem-wired such that power to each of the 5 lamps can be controlled separately by the photocontrol based on available daylight.



Example 5-2

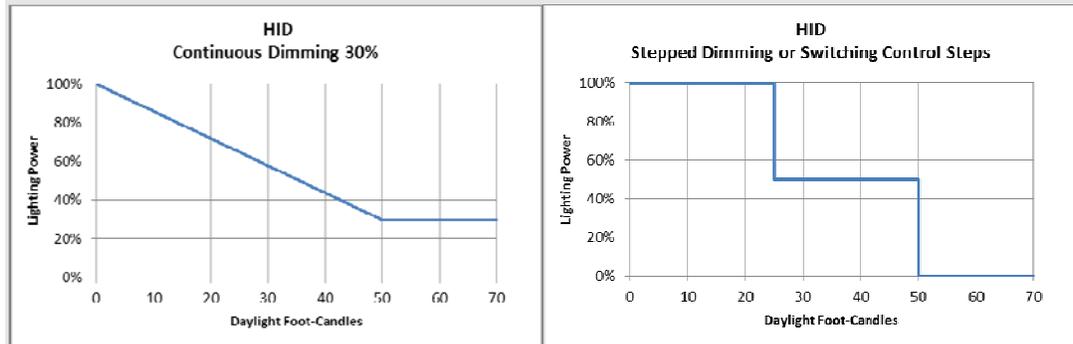
Methods for complying with the mandatory daylight control requirements for a space with HID lighting

The Standards require that automatic daylighting controls shall provide functional multi-level lighting levels having at least the number of control steps specified in TABLE 5-1 (Table 130.1-A in the Standards).

Per Table 5-1, a space with HID lamps that are greater than 20 Watts installed power per lamp, shall have a minimum of 1-step between 50% and 70%.

This can be achieved in one of three ways, using:

- A. Continuous dimming - Here the photocontrol gradually dims all luminaires in the daylit zone in response to the available daylight.
- B. Stepped dimming - Here the photocontrol signals the stepped dimming ballast to reduce power in incremental steps such there is one control step between 50% and 70% as noted above.
- C. Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire. Here the lamps may be tandem-wired such that power to each lamp in the luminaire can be controlled separately by the photocontrol based on available daylight.



Example 5-3

Complying with the 150 percent of the design illuminance daylighting requirement

When the illuminance received from the daylight is greater than 150 percent of the design illuminance (or nighttime electric lighting illuminance), the general lighting power in the daylight zone must reduce by a minimum of 65%.

For example, a space has 500 Watts of installed lighting power in daylit zones. The design illuminance for the space is 50 footcandles (fc). When the available daylight in the space reaches 75fc (i.e. 150% of 50fc), then the power consumed by the general lighting in the daylit zones should be 175 Watts or lower.

These requirements call for “all zones being served by controlled lighting” between 100 and 150 percent of the nighttime electric lighting illuminance. Without checking all points in the 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”

Figure 5-5 Fluorescent Dimming Controls

Figure 5-5 plots the performance of complying (“Acceptable” and “Max Savings”) and non-complying (“Under-dimming” and “Over-dimming”) controls. By fully dimming when daylight is 150 percent of the reference illuminance and also assuring that the total illuminance never falls below the reference illuminance (50 fc), the “Acceptable” control is minimally compliant with the requirements of §130.1(d)2D. Even greater savings are possible with the “Max Savings” control that maintains the 50 fc reference under all partially daylight conditions and is fully dimmed at 150 percent of the reference illuminance.

The “Under-dimming” control is only 30 percent dimmed when the daylight in the darkest portion of the zone served by the controlled lighting is at 150 percent of the reference illuminance (75 fc). The “Under-dimming” control does not save enough energy and thus is not code compliant. The “Over-dimming” condition reduces the electric lighting by more than the amount of daylight that enters the space. As a result, it actually is darker in portions of the space under partial daylight conditions than it is at night. In the short term, the “Over-dimming” control may save the most energy.

However, over the long term it is likely that the occupants may disable the control and the control would save no energy. As a result the “Over-dimming” control is not code compliant.

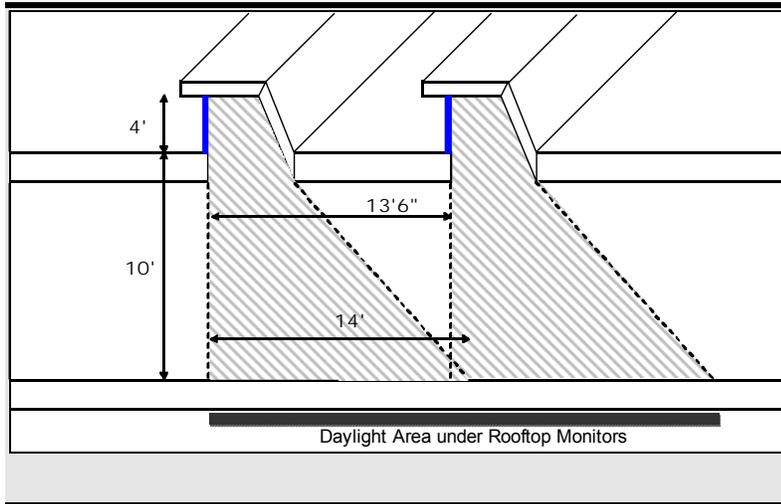
These performance metrics of complying and non-complying control systems are the basis of the functional performance tests for the Automatic Daylighting Controls acceptance test. This test is described in detail in Chapter 10 – Acceptance Testing.

Example 5-4**Question**

Draw the daylit zone for two roof top monitors with four 4 foot long windows projecting over a 10 ft tall roof. The two monitors are 13.5 ft apart.

Answer

Standards currently define skylights as glazing having a slope less than 60 degrees from the horizontal with conditioned or unconditioned space below. Since rooftop monitors have a slope greater than 60 degrees, they are therefore considered to be windows.



2. When the illuminance received from the daylight is greater than 150 percent of the design illuminance (or nighttime electric lighting illuminance), the general lighting power in the daylight zone must reduce by a minimum of 65%.

For example, a space has 500 Watts of installed lighting power in daylit zones. The design illuminance for the space is 50 footcandles (fc). When the available daylight in the space reaches 75fc (i.e. 150% of 50fc), then the power consumed by the general lighting in the daylit zones should be 175 Watts or lower.

These requirements call for “all zones being served by controlled lighting” between 100 and 150 percent of the nighttime electric lighting illuminance. Without checking all points in the 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” in Figure 5-15.

Example 5- and **Error! Reference source not found.** plot the performance of switching and dimming automatic daylighting controls (photocontrols). The performance is indicated in terms of lighting at the darkest point of the zone served by the controlled lighting (indicated as the Reference Location in Figure 5-15). The total lighting as plotted on the y-axis made up of both daylight and electric lighting contribution to total footcandles at this darkest location in the zone served by the controlled lighting. Daylight plotted on the x-axis is just the daylight available at this darkest location.

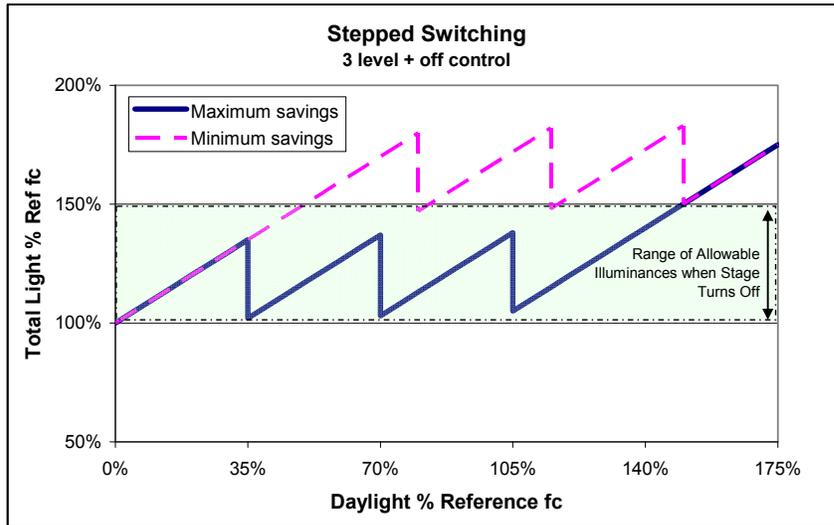


Figure 5-6 Stepped Switching

In **Error! Reference source not found.**3, the light levels are given as a fraction of the reference or design footcandles (fc). The bottom points of both controls indicate the total illuminance just after a stage of lighting has switched off. Both controls are compliant because the total illuminance at the darkest location in the zone served by controlled lighting just after switching off a stage of lighting is between 100 and 150 percent of the reference illuminance. The reference illuminance is the illuminance at this same location when there is no daylight (night time).

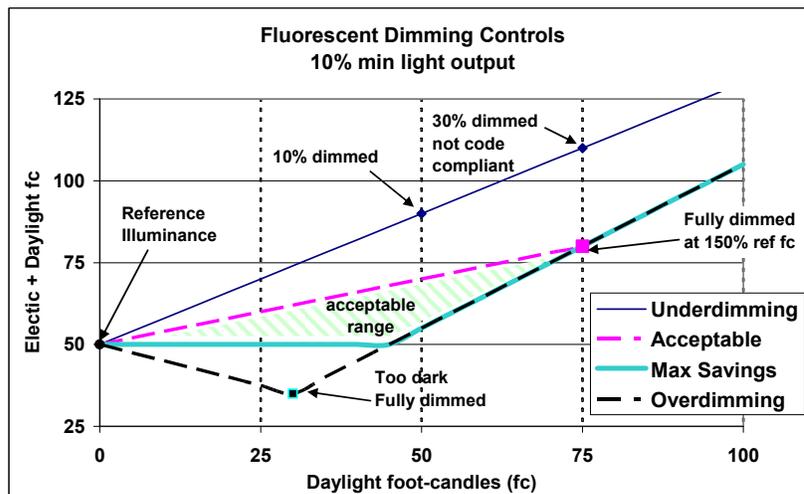


Figure 5-7 Fluorescent Dimming Controls

Figure 5-54 plots the performance of complying (“Acceptable” and “Max Savings”) and non-complying (“Under-dimming” and “Over-dimming”) controls. By fully dimming when daylight is 150 percent of the reference illuminance and also assuring that the total illuminance never falls below the reference illuminance (50 fc), the “Acceptable” control is minimally compliant with the requirements of §130.1(d)2D. Even greater savings are possible with the “Max Savings” control that maintains the 50 fc reference under all partially daylight conditions and is fully dimmed at 150 percent of the reference illuminance.

The “Under-dimming” control is only 30 percent dimmed when the daylight in the darkest portion of the zone served by the controlled lighting is at 150 percent of the reference illuminance (75 fc). The “Under-dimming” control does not save enough energy and thus is not code compliant. The “Over-dimming” condition reduces the electric lighting by more than the amount of daylight that enters the space. As a result, it actually is darker in portions of the space under partial daylight conditions than it is at night. In the short term, the “Over-dimming” control may save the most energy.

However, over the long term it is likely that the occupants may disable the control and the control would save no energy. As a result the “Over-dimming” control is not code compliant.

These performance metrics of complying and non-complying control systems are the basis of the functional performance tests for the Automatic Daylighting Controls acceptance test. This test is described in detail in Chapter 10 – Acceptance Testing.

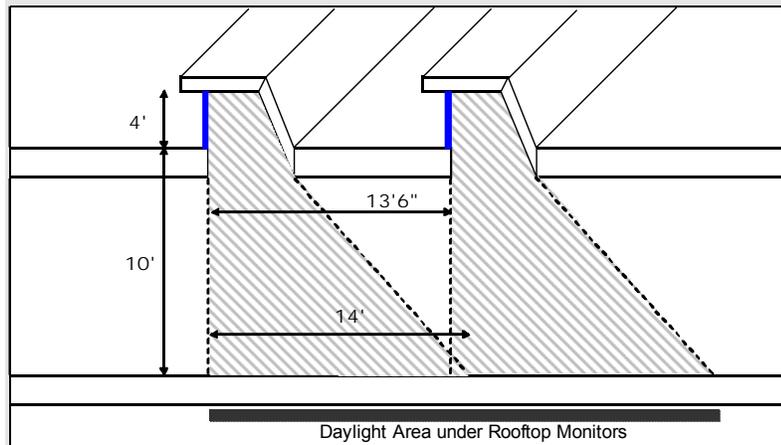
Example 5-5

Question

Draw the daylight zone for two rooftop monitors with four 4 foot long windows projecting over a 10 ft tall roof. The two monitors are 13.5 ft apart.

Answer

Standards currently define skylights as glazing having a slope less than 60 degrees from the horizontal with conditioned or unconditioned space below. Since rooftop monitors have a slope greater than 60 degrees, they are therefore considered to be windows.



5.6 General Prescriptive Lighting Requirements

See section 5.5 of this chapter for the prescriptive daylighting requirements.

5.6.1 Requirements for a Compliant Building

A building complies with §140.6 if:

- i. The Calculation of Actual Indoor Lighting Power of all proposed building areas combined, when calculated in accordance with §140.6(a) is no greater than the Calculation of Allowed Indoor Lighting Power, Specific Methodologies calculated under §140.6(c); and
- ii. The Calculation of Allowed Indoor Lighting Power, General Rules comply with §140.6(b); and
- iii. General lighting complies with the Automatic Daylighting Controls in Secondary Daylit Zone requirements in §140.6(d).

5.6.2 Calculation of Actual Indoor Lighting Power

- (a) The actual indoor Lighting Power of all building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building.
- (b) Some adjustments are available to reduce the actual indoor lighting power that must be reported. These adjustments are discussed in section 5.4.5 of this chapter.

5.6.3 Portable Office Lighting

The Standards require that all planned portable lighting be counted toward the building's lighting energy use, regardless of the function area in which it is planned for.

Because office furniture is typically not installed until after the building inspection is complete, there are special provisions for portable lighting in office areas. Up to 0.3 watts per square foot of portable lighting for office areas shall not be required to be included in the calculation of actual indoor Lighting Power. However, if more than 0.3 watts per square foot of portable lighting is installed in office areas, any portable lighting wattage above 0.3 watts per square foot shall be required to be included in the calculation of actual indoor Lighting Power.

The Standards define portable lighting as lighting with plug-in connections for electric power, that is: table and freestanding floor lamps; attached to modular furniture; workstation task luminaires; luminaires attached to workstation panels; attached to movable displays; or attached to other personal property.

5.6.4 Two interlocked lighting systems

- A. For only the following five specifically function areas, as defined in §100.1(b), the Standards accommodate two different lighting systems to be installed:
1. Auditorium
 2. Convention center
 3. Conference room
 4. Multipurpose room
 5. Theater

All other function areas are permitted to install only one lighting system.

- B. No more than two lighting systems may be used for these five specifically defined function areas, and if there are two lighting systems, they must be interlocked.
- C. Where there are two interlocked lighting systems, the watts of the lower wattage system may be excluded from determining the actual indoor Lighting Power if:

1. Before two interlocked lighting systems will be recognized for compliance with the lighting requirements in Part 6 of Title 24, 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 Installation Certificate.

If any of the requirements in the Installation Certificate fail the installation tests, the two interlocked lighting systems shall not be recognized for compliance with the lighting Standards; and

2. The two lighting systems shall be interlocked with a Nonprogrammable Double-Throw Switch to prevent simultaneous operation of both systems.
3. For compliance with the Standards 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.

5.6.5 Reduction of wattage through controls (PAFs)

- A. The Standards provide Power Adjustment Factors (PAFs) when specific lighting controls are installed, provided those lighting controls are not required by the Standards.
- B. A Power Adjustment Factor is an adjustment, or credit, to the actual installed lighting power in a space, so that when completing the compliance documentation, some of the installed lighting power is not counted toward the building's total installed lighting load.

- C. In calculating actual installed indoor Lighting Power, the installed watts of a luminaire providing general lighting in a function area listed in TABLE 5-2 may be reduced by multiplying the number of watts controlled (as described in TABLE 5-2) times the applicable Power Adjustment Factor (PAF).
- D. To qualify for a PAF, the following conditions are required to be met:
1. Before a Power Adjustment Factor will be allowed for compliance with §140.6 of Part 6 of Title 24, 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 Installation Certificate.

If any of the requirements in this Installation Certificate fail the Power Adjustment Factor installation tests, the installation shall not be eligible for using the PAF; and
 2. Luminaires and controls meet the applicable requirements of §110.9, and §§ 130.0 through 130.5; and
 3. The controlled lighting is permanently installed general lighting systems and the controls are permanently installed nonresidential-rated lighting controls. (Thus, for example, portable lighting, portable lighting controls, and residential rated lighting controls shall not qualify for PAFs.)
 - a. There are furniture mounted lighting systems that are installed to provide general lighting. When used for determining PAFs for general lighting in offices, furniture mounted luminaires that comply with all of the following conditions shall qualify as permanently installed general lighting systems:
 - i. The furniture mounted luminaires shall be permanently installed no later than the time of building permit inspection; and
 - ii. The furniture mounted luminaires shall be permanently hardwired; and
 - iii. The furniture mounted lighting system shall be designed to provide indirect general lighting. It may also have elements that provide direct task lighting; and
 - iv. Before multiplying the installed watts of the furniture mounted luminaire by the applicable PAF, 0.3 watts per square foot of the area illuminated by the furniture mounted luminaires shall be subtracted from installed watts of the furniture mounted luminaires to account for portable lighting; and
 - v. The lighting control for the furniture mounted luminaire complies with all other applicable requirements in §140.6(a)2.
 4. At least 50 percent of the light output of the controlled luminaire is within the applicable area listed in TABLE 5-2. Luminaires on lighting tracks shall be within the applicable area in order to qualify for a PAF.
 5. Only one PAF from TABLE 5-2 may be used for each qualifying luminaire. PAFs shall not be added together unless specifically allowed in TABLE 5-2.

6. Only lighting wattage directly controlled in accordance with §140.6(a)2 shall be used to reduce the calculated actual indoor Lighting Power Densities 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 actual indoor Lighting Power.
7. Lighting controls used to qualify for a PAF shall be designed and installed in addition to manual, multi-level, and automatic lighting controls required in §130.1, and in addition to any other lighting controls required by any provision of the Standards.

EXCEPTION to §140.6(a)2G: Lighting controls designed and installed for the sole purpose of compliance with §130.1(b)3 (these are the additional lighting controls required for compliance with the multi-level lighting control requirements) may be used to qualify for a PAF, provided the lighting controls are designed and installed in addition to all manual, and automatic lighting controls otherwise required in §130.1.

8. To qualify for the PAF for a Partial-ON Occupant Sensing Control in TABLE 5-2, a Partial-On Occupant Sensing Control shall meet all of the following requirements:
 - a. The control shall automatically deactivate all of the lighting power in the area within 30 minutes after the room has been vacated; and
 - b. The first stage shall automatically activate between 30-70 percent of the lighting power in the area and may be a switching or dimming system; and
 - c. The second stage shall require manual activation of the alternate set of lights, and this manual-ON requirements shall not be capable of conversion from manual-ON to automatic-ON functionality via manual switches or dip switches; and
 - d. Switches shall be located in accordance with §130.1(a) and shall allow occupants to manually do all of the following regardless of the sensor status: activate the alternate set of lights in accordance with item (iii); activate 100 percent of the lighting power; and deactivate all of the lights.
9. To qualify for the PAF for an occupant sensing control controlling the general lighting in large open plan office areas above workstations, in accordance with TABLE 5-2, the following requirements shall be met:
 - a. The open plan office area shall be greater than 250 square feet; and
 - b. This PAF shall be available only in office areas which contain workstations; and
 - c. Controlled luminaires shall only be those which 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; and

- d. Qualifying luminaires shall be controlled by occupant sensing controls that meet all of the following requirements, as applicable:
 - i. Infra-red sensors shall be equipped by the manufacturer, of fitted in the field by the installer, with lenses or shrouds to prevent them from being triggered by movement outside of the controlled area.
 - ii. Ultrasonic sensors shall be tuned to reduce their sensitivity to prevent them from being triggered by movements outside of the controlled area.
 - iii. All other sensors shall be installed and adjusted as necessary to prevent them from being triggered by movements outside of the controlled area.
10. To qualify for the PAF for a Manual Dimming System PAF or a Multiscene Programmable Dimming System PAF in TABLE 5-2, the lighting shall be controlled with a control that can be manually operated by the user.
11. To qualify for the PAF for a Demand Responsive Control in TABLE 5-2, a Demand Responsive Control shall meet all of the following requirements:
 - a. Because buildings larger than 10,000 square feet are required to have demand responsive controls, to qualify for the PAF, the building shall be 10,000 square feet or smaller; and
 - b. The controlled lighting shall be capable of being automatically reduced in response to a demand response signal; and
 - c. Lighting shall be reduced in a manner consistent with uniform level of illumination requirements in TABLE 5-1; and
 - d. Spaces that are non-habitable shall not be used to comply with this requirement, and spaces with a lighting power of less than 0.5 watts per square foot shall not be counted toward the building's total lighting power.
12. To qualify for the PAF for Combined Manual Dimming plus Partial-ON Occupant Sensing Control in TABLE 5-2, (i) the lighting controls shall comply with the applicable requirements in §140.6(a)2J; and (ii) the lighting shall be controlled with a dimmer control that can be manually operated, or with a multi-scene programmable control that can be manually operated.

**TABLE 5- 2: (Table 140.6-A in the Standards)
 Lighting Power Density Adjustment Factors (PAF)**

TYPE OF CONTROL		TYPE OF AREA		FACTOR
a. To qualify for any of the Power Adjustment Factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2 b. Only one PAF may be used for each qualifying luminaire unless combined below. c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF				
1. Partial-ON Occupant Sensing Control		Any area \leq 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, conference or waiting room.		0.20
2. Occupant Sensing Controls in Large Open Plan Offices		In open plan offices > 250 square feet: One sensor controlling an area that is:	No larger than 125 square feet	0.40
			From 126 to 250 square feet	0.30
			From 251 to 500 square feet	0.20
3. Dimming System	Manual Dimming	Hotels/motels, restaurants, auditoriums, theaters		0.10
	Multiscene Programmable			0.20
4. Demand Responsive Control		All building types less than 10,000 square feet. Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF		0.05
5. Combined Manual Dimming plus Partial-ON Occupant Sensing Control		Any area \leq 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, conference or waiting room		0.25

5.6.6 Lighting Wattage Not Counted Toward Building Load

The Standards do not require lighting power in specific function areas, or for specific purposes, to be counted toward a building’s installed lighting power.

Any nonresidential indoor lighting function not specifically listed below shall comply with all applicable nonresidential indoor lighting requirements in the Standards. For example, lighting in guestrooms of hotels is not required to be counted for compliance with §140.6, however, lighting in all other function areas within a motel are required to comply with all applicable requirements in §140.6. Also, lighting in within the guestrooms is regulated by the residential lighting Standards.

The watts of the following indoor lighting applications are not required to be counted toward the actual installed indoor Lighting Power.

- A. In theme parks: Lighting for themes and special effects.
- B. Studio lighting for film or photography provided that these lighting systems are in addition to and separately switched from a general lighting system.
- C. Lighting for dance floors, lighting for theatrical and other live performances, and theatrical lighting used for religious worship, provided that these lighting systems are additions to a general lighting system and

- are separately controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.
- D. In civic facilities, transportation facilities, convention centers, and hotel function areas: Lighting for temporary exhibits, if the lighting is an addition to a general lighting system and is separately controlled from a panel accessible only to authorized operators.
 - E. Lighting installed by the manufacturer in walk-in freezers, vending machines, food preparation equipment, and scientific and industrial equipment.
 - F. In medical and clinical buildings: Examination and surgical lights, low-ambient night-lights, and lighting integral to medical equipment, provided that these lighting systems are additions to and separately switched from a general lighting system.
 - G. Lighting for plant growth or maintenance, if it is controlled by a multi-level astronomical time-switch control that complies with the applicable provisions of §110.9.
 - H. Lighting equipment that is for sale.
 - I. Lighting demonstration equipment in lighting education facilities.
 - J. Lighting that is required for exit signs subject to the CBC. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.
 - K. Exitway or egress illumination that is normally off and that is subject to the CBC.
 - L. In hotel/motel buildings: Lighting in guestrooms (lighting in hotel/motel guestrooms shall comply with §130.0(b). (Indoor lighting not in guestrooms shall comply with all applicable nonresidential lighting requirements in Part 6.)
 - M. In high-rise residential buildings: Lighting in dwelling units (Lighting in high-rise residential dwelling units shall comply with §130.0(b).) (Indoor lighting not in dwelling units shall comply with all applicable nonresidential lighting requirements in Part 6.)
 - N. Temporary lighting systems. *Temporary Lighting is defined by the Standards as a lighting installation with plug-in connections, that does not persist beyond 60 consecutive days or more than 120 days per year.*
 - O. Lighting in occupancy group U buildings less than 1,000 square feet.
 - P. Lighting in unconditioned agricultural buildings less than 2,500 square feet.
 - Q. 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 historic replica components are exempt. All other lighting systems in qualified historic buildings shall comply with the Lighting Power allowances.

- R. Lighting in nonresidential parking garages for seven or less vehicles:
Lighting in nonresidential parking garages for seven or less vehicles shall comply with the applicable residential parking garage provisions of §150.0(k).
- S. Lighting for signs: Lighting for signs shall comply with §140.8.
- T. Lighting for automatic teller machines that are located inside parking garages.
- U. Lighting in refrigerated cases less than 3,000 square feet. (Lighting in refrigerated cases less than 3,000 square feet shall comply with the Title 20 Appliance Efficiency Regulations).
- V. Lighting in elevators where the lighting meets the requirements of ASHRAE/IESNA Standard 90.1, 2010.

5.7 Prescriptive Lighting Methods

This section contains information on the three prescriptive approaches available for complying with the Lighting Standards:

- A. Complete Building Method
- B. Area Category Method
- C. Tailored Method

5.7.1 Complete Building Method

§140.6(c)1

Standards Table 140.6-B

- A. The Complete Building Method shall only be applied when all areas in the entire building are complete (i.e., lighting will be installed throughout the entire building under the permit for which the Standards compliance is prepared). The building must consist of one type of use for a minimum of 90 percent of the floor area of the entire building.
- B. The Allowed Indoor Lighting Power allotment for general lighting for the entire building shall be calculated as follows:
 - 1. For a conditioned building that qualifies to use the Complete Building Method of compliance, multiply the square feet of conditioned space of the building times the applicable allotment of watts per square foot described in TABLE 5-3.
 - 2. For an unconditioned building that qualifies to use the Complete Building Method of compliance, multiply the square foot of unconditioned space of the building times the applicable allotment of watts per square feet described in TABLE 5-3.
- C. Requirements for using the Complete Building Method include all of the following:
 - 1. The Complete Building Method shall be used only for building types, as defined in §100.1, that are specifically listed in TABLE 5-3. (For example, retail and wholesale stores, hotel/motel, and high-rise residential buildings shall not use this method.)
 - 2. The Complete Building Method shall be used only on projects involving:
 - a) Entire buildings with one type of use occupancy; or
 EXCEPTION to §140.6(c)1Bi: If a parking garage plus another type of use listed in TABLE 5-3 are part of a single building, the parking garage portion of the building and other type of use portion of the building shall each separately use the Complete Building Method.
 - 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); or

- 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).
3. The Complete Building Method shall be used only when the applicant is applying for a lighting permit and submits plans and specifications for the entire building or the entire tenant space.
4. Only the lighting power allotment in Table 5-3 is available for the entire building when using the Complete Building Method. 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.

D. Definitions of Complete Building Types

When using the Complete Building Method, qualifying building types shall be only those in which a minimum of 90 percent of the building floor area functions as one of the building types listed in Table 5-3 of the Standards, as defined below, which do not qualify as any other Building Occupancy Types more specifically defined in §100.1, and which do not have a combined total of more than 10 percent of the area functioning of any Nonresidential Function Areas specifically defined in §100.1:

- **Auditorium Building** is a public building in which a minimum of 90 percent of the building floor area are rooms with fixed seating that are primarily used for public meetings or gatherings
- **Classroom Building** is a building for an educational institution in which a minimum of 90 percent of the building floor area are classrooms or educational laboratories
- **Commercial and Industrial Storage Building** is a building for which a minimum or 90 percent of the building floor area is used for storing items
- **Convention Center Building** is a building in which a minimum of 90 percent of the building floor area are rooms for meetings and conventions, which have neither fixed seating nor fixed staging.
- **Financial Institution Building** is a building in which a minimum of 90 percent of the building floor area are rooms used for an institution which collects funds from the public and places them in financial assets, such as deposits, loans, and bonds.
- **General Commercial and Industrial Work Building** is a building in which a minimum of 90 percent of the building floor area are rooms for performing a craft, assembly or manufacturing operation.
- **Grocery Store Building** is a building in which a minimum of 90 percent of the building floor area is sales floor for the sale of foodstuffs.
- **Library Building** is a building which is in which a minimum of 90 percent of the building floor area are rooms use as a repository of literary materials, such as books, periodicals, newspapers, pamphlets and prints, are kept for reading or reference.
- **Medical Buildings and Clinic Buildings** are non “I” occupancy buildings in which a minimum of 90 percent of the building floor area are rooms where medical or clinical care is provided, does not provide overnight

patient care, and is used to provide physical and mental care through medical, dental, or psychological examination and treatment.

- **Office Building** is a building of CBC Group B Occupancy in which a minimum of 90 percent of the building floor area are rooms in which business, clerical or professional activities are conducted.
- **Parking Garage Building** is a building in which a minimum of 90 percent of the building floor area is for the purpose of parking vehicles, which 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 in which a minimum of 90 percent of the floor area in the building floor area are rooms for assembly of people to worship.
- **Restaurant Building** is a building in which a minimum of 90 percent of the building floor area are rooms in which food and drink are prepared and served to customers in return for money.
- **School Building** is a building in which a minimum of 90 percent of the building floor area is used for an educational institution, but in which less than 90 percent of the building floor area is classrooms or educational laboratories, and may include an auditorium, gymnasium, kitchen, library, multi-purpose room, cafeteria, student union, or workroom. A maintenance or storage building is not a school building.
- **Theater Building** is a building in which a minimum of 90 percent of the building floor area are rooms having tiers of rising seats or steps for the viewing of motion pictures, or dramatic performances, lectures, musical events and similar live performances.

**TABLE 5- 3: (Table 140.6-B in the Standards)
Complete Building Method Lighting Power Density Values (W/ft²)**

TYPE OF USE	ALLOWED LIGHTING POWER
Auditorium Building	1.5
Classroom Building	1.1
Commercial and Industrial Storage Buildings	0.6
Convention Center Building	1.2
Financial Institution Building	1.1
General Commercial Building / Industrial Work Building	1.0
Grocery Store Building	1.5
Library Building	1.3
Medical Buildings / Clinic Building	1.1
Office Building	0.8
Parking Garage Building	0.2
Religious Facility Building	1.6
Restaurant Building	1.2
School Building	1.0
Theater Building	1.3
All other Buildings	0.6

Example 5-6 Finding Lighting Power Density Allotment using table

Question

A 10,000-ft² medical clinic building is to be built. What is its Lighting Power Density Allotment under the complete building approach?

Answer

From Table 146-B in the Standards, medical buildings and clinics are allowed 1.1 W/ft². The Lighting Power Density Allotment is 10,000 x 1.1 = 11,000 W.

5.7.2 Area Category Method

§140.6(c)2; Standards Table 140.6-C

A. Area Category Method General Lighting Power Allotment

1. The Area Category Method is more flexible than the Complete Building Method because it can be used for multiple tenants or partially completed buildings. For purposes of 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 **Error! Reference source not found.** (Table 140.6-C in the Standards). Areas not covered by the current permit are ignored. 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.
2. The Area Category Method divides a building into primary function areas. Each function area is defined under occupancy type in §100.1 in the Standards. The Lighting Power Allotment 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 is the summation of the Lighting Power Allotment for each area covered by the permit application.

3. 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.
4. Requirements for using the Area Category Method include all of the following:
 - a. The Area Category Method shall be used only for primary function areas, as defined in §100.1, that are listed in TABLE 5-4.
 - b. Primary Function Areas in TABLE 5-4 shall not apply to a complete building. Each primary function area shall be determined as a separate area.
 - c. 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.
 - d. 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.
 - e. If at the time of permitting for a newly constructed building, a tenant is not identified for a multi-tenant area, a maximum of 0.6 watts per square foot 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.
 - f. Under the Area Category Method, the allowed indoor Lighting Power Density for each primary area is the Lighting Power Density value in TABLE 5-4 times the square feet of the primary function. The total allowed indoor Lighting Power Density for the building is the sum of all allowed indoor Lighting Power Densities for all areas in the building.

B. Additional Lighting Power - Area Category Method

1. In addition to the allowed indoor Lighting Power calculated according to §s 140.6(c)2, the building may add additional lighting power allowances for specialized task work, ornamental, precision, accent, display, decorative, and white boards and chalk boards, in accordance with the footnotes in TABLE 5-4 under the following conditions:
 - a. Only primary function areas having a footnote next to the allowed Lighting Power Density allotments in TABLE 5-4 shall qualify for the added lighting

- power allowances in accordance with the correlated footnote listed at the bottom of the table; and
- b. The additional lighting power allowances shall be used only if the plans clearly identify all applicable task areas and the lighting equipment designed to illuminate these tasks; and
 - c. Tasks that are performed less than two hours per day or poor quality tasks that can be improved are not eligible for the additional lighting power allowances; and
 - d. The additional lighting power allowances shall not utilize any type of luminaires that are used for general lighting in the building; and
 - e. The additional lighting power allowances shall not be used when using the Complete Building Method, or when the Tailored Method is used for any area in the building; and
 - f. The additional lighting power allowed is the smaller of lighting power listed in the applicable footnote in TABLE 5-4, or the actual design wattage; and
 - g. In addition to all other additional lighting power allowed under §140.6(c)2G(i through vi), up to 1.5 watts per square foot of additional lighting power 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 Part 6 of Title 24, 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 Installation Certificate.

If any of the requirements in this Installation Certificate fail the Additional Videoconference Studio Lighting installation tests, the installation shall not be eligible for the additional lighting power allotment; and
 - 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; and
 - iii. General lighting is switched in accordance with TABLE 5-1; and
 - iv. Wall wash lighting is separately switched from the general lighting system; and
 - 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 multiscene programmable control system (also known as a scene preset control system).

Example 5-7 Calculating allowed lighting power**Question**

A small bank building has the following area distribution:

Corridors	800 ft ²
Main Entry Lobby	200 ft ²
Financial Transactions	1,200 ft ²
Manager's Office	200 ft ²

What is the allowed lighting power for this building under the Area Category Method?

Answer

The following Lighting Power Densities apply (from Table 140.6-C in the Standards):

Space	LPD	Area	Allowed Watts
Corridors	0.6 W	800 ft ²	480
Main Entry	1.5 W	200 ft ²	300
Financial Transactions	1.2 W	1200 ft ²	1440
Manager's Office	1.0 W	200 ft ²	200
Total			2420 W

Financial Transactions in this example are assumed to include all the spaces in which financial transactions for the public are taking place. The allowed lighting power for this building is 2420 W

Example 4-15 Allowed lighting power including decorative lighting**Question:**

What is the allowed maximum lighting power if the small bank in example 4-14 above incorporates decorative chandeliers and wall sconces as part of their lighting design?

Answer:

Provided the decorative lighting occurs in either the Financial Transaction area or Main Lobby and is, in addition to the general lighting, up to 0.5W/ft² added power is allowed for these areas. Therefore the added maximum power is as follows:

$$\text{Main Entry} \quad 0.5\text{W} \times 200 \text{ ft}^2 = 100\text{W}$$

$$\text{Financial Transactions} \quad 0.5\text{W} \times 1200 \text{ ft}^2 = 600\text{W}$$

The maximum total of added watts allowed for the ornamental lighting (Chandeliers and sconces) is $100 + 600 = 700\text{W}$.

With the addition of these 700W is revised allowed maximum watts for the small bank is 3120W ($2420 + 700 = 3120$).

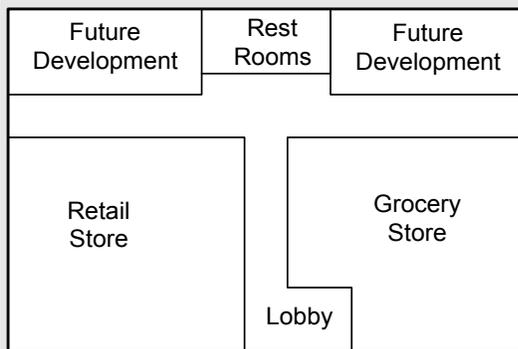
Note that ornament lighting is "use-it-loose" therefore actual allowed maximum watts for the small bank is the base 2420W + the smaller of the actual power of the ornamental lighting or 700W. Therefore if the ornamental lighting uses 300W the total allowed maximum is 2720W for the bank not 3120W. ($2420 + 300 = 2720$)

Example 4-16 Allowed lighting power for multi-use spaces

Question

A 10,000-ft² multi-use building is to be built consisting of:

- A) 500 ft² main entry lobby,
- B) 2,000 ft² corridors and restroom,
- C) 3,000 ft² grocery store,
- D) 2,500 ft² retail, and
- E) 2,000 ft² future development.



What is the allowed lighting power under the area category method?

Answer

Space	LPD	Area	Allowed Watts
A) Main Entry	1.5 W/ft ²	500 ft ²	750
B) Corridors and Restrooms	0.6 W/ft ²	2,000 ft ²	1,200
C) Grocery Sales	1.2 W/ft ²	3,000 ft ²	3,600
D) Retail Store	1.2 W/ft ²	2,500 ft ²	3,000
TOTAL		8,000 ft ²	8,550

with 2,000 ft² for future development.

Example 4-17 Maximum allowed wattage for spaces within a multiuse building

Question

What if in the multi-use building (example 4-16), the retail store is planning floor displays and wall displays, as well as decorative chandlers. How do you determine the allowed maximum watts for this store?

Answer

- A) As in the above example, determine the total square feet of the retails store (2500 feet)

B) As in the above example multiply the allowed LPD (1.2 W/ft^2) X 2500 = 3000W (base allowance)

C) Determine the maximum allowed display and accent allowance by multiplying the retail stores 2500 feet by 0.3 W/ft^2 (Footnote 6 from Table 5-4 of the Standards) = 750W

D) Determine the maximum allowed ornamental lighting allowance (for chandeliers) by multiplying the retail stores 2500 feet by 0.2 W/ft^2 (Footnote 6 from Table 5-4 of the Standards) = 500W

E) Add the 3000W base plus 750W for display and 500W for ornamental = 4250W

The maximum allowed watts for this retail store, under the area method, is therefore 4,250W or 1.7 W/ft^2

NOTE: The allowed maximum is usually somewhat less than the theoretical maximum of 1.7 W/ft^2 as the display/accent lighting and ornamental lighting components are “use-it-loose it” with the lower luminaire lighting power becoming the allowed power. Also for the added power to be allowed, it must be in addition to general lighting and must use the appropriate luminaires for the task as defined the luminaires

Example 5-18 Decorative lighting

Question

What is the wattage allowance for a 10 ft^3 chandelier with 5-50 W lamps in a 300 ft^2 bank entry lobby?

Answer

The wattage based on the task space is $0.5 \text{ W/ft}^2 \times 300 \text{ ft}^2 = 150 \text{ W}$

The wattage based on actual design watts is 250 W.

The wattage allowance for the chandelier is the smaller of the two values, or 150 W

Example 5-19 Decorative LED lighting

Question

What is the wattage allowance for a LED chandelier with 5-10 W LED lamps in a 300 ft^2 bank entry lobby?

Answer

The wattage based on the task space is $0.5 \text{ W/ft}^2 \times 300 \text{ ft}^2 = 150 \text{ W}$

The wattage based on actual design watts is 50 W.

The wattage allowance for the chandelier is the smaller of the two values, or 50 W

**TABLE 5- 4: (Table 140.6-C in the Standards)
Area Category Method- Lighting Power Density Values (Watts/ ft²)**

PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER (W/ft ²)	PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER (W/ft ²)
Auditorium Area		1.5 ³	Library Area	Reading areas	1.2 ³
Auto Repair Area		0.9 ²		Stack areas	1.5 ³
Beauty Salon Area		1.7	Lobby Area	Hotel lobby	1.1 ³
Civic Meeting Place Area		1.3 ³		Main entry lobby	1.5 ³
Classroom, Lecture, Training, Vocational Areas		1.2 ⁵	Locker/Dressing Room		0.8
Commercial and Industrial Storage Areas (conditioned and unconditioned)		0.6	Lounge Area		1.1 ³
Commercial and Industrial Storage Areas (refrigerated)		0.7	Malls and Atria		1.2 ³
Convention, Conference, Multipurpose and Meeting Center Areas		1.4 ³	Medical and Clinical Care Area		1.2
Corridor, Restroom, Stair, and Support Areas		0.6	Office Area	> 250 square feet	0.75
Dining Area		1.1 ³		≤ 250 square feet	1.0
Electrical, Mechanical, Telephone Rooms		0.7 ²	Parking Garage Area	Parking Area	0.14
Exercise Center, Gymnasium Areas		1.0		Dedicated Ramps	0.3
Exhibit, Museum Areas		2.0		Daylight Adaptation Zones ⁹	0.6
Financial Transaction Area		1.2 ³	Religious Worship Area		1.5 ³
General Commercial and Industrial Work Areas	Low bay	0.9 ²	Retail Merchandise Sales, Wholesale Showroom Areas		1.2 ^{6 and 7}
	High bay	1.0 ²			
	Precision	1.2 ⁴	Theater Area	Motion picture	0.9 ³
Grocery Sales Area		1.2 ^{6 and 7}		Performance	1.4 ³
Hotel Function Area		1.5 ³	Transportation Function Area		1.2
Kitchen, Food Preparation Areas		1.6	Videoconferencing Studio		1.2 ⁸
Laboratory Area, Scientific		1.4 ¹	Waiting Area		1.1 ³
Laundry Area		0.9	All other areas		0.6
Footnotes for this table are listed below.					

FOOTNOTES FOR Table 5-4 (Table 140.6-C in the Standards):

See § 140.6(c)2 for an explanation of additional lighting power available for specialized task work, ornamental, precision, accent, display, decorative, and white boards and chalk boards, in accordance with the footnotes in this table.

The smallest of the added lighting power listed in each footnote below, or the actual design wattage, may be added to the allowed lighting power only when using the Area Category Method of compliance.

Footnote number	Type of lighting system allowed	Maximum allowed added lighting power. (W/ft ² of task area unless otherwise noted)
1	Specialized task work	0.2 W/ft ²
2	Specialized task work	0.5 W/ft ²
3	Ornamental lighting as defined in § 100.1 and in accordance with § 140.6.(c)2.	0.5 W/ft ²
4	Precision commercial and industrial work	1.0 W/ft ²
5	Per linear foot of white board or chalk board.	5.5 W per linear foot
6	Accent, display and feature lighting - luminaires shall be adjustable or directional	0.3 W/ft ²
7	Decorative lighting - primary function shall be decorative and shall be in addition to general illumination.	0.2 W/ft ²
8	Additional Videoconferencing Studio lighting complying with all of the requirements in § 140.6(c)2Gvii.	1.5 W/ft ²
9	Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage	

5.7.3 Tailored Method

§140.6(c)3

Standards Table 140.6-D

A. 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. In addition to providing a lighting power budget for general illumination, this compliance approach provides additional lighting power budgets for illuminating wall displays, floor displays, task lighting, and ornamental/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 Whole Building Method of compliance is used.

Use of Tailored Method may also be helpful when a function area has a high room cavity ratio (RCR).

The Standards allow the Tailored Method to be used for only a limited number of primary function areas. The primary function area shall only be one of the following:

1. As specifically listed in Table 5-6 (Table 140.6-D of the Standards), or
2. As specifically listed in §140.6(c)3H.

Some of the Tailored Method Primary function areas that were previously allowed in the 2008 Standards have been removed.

B. Tailored Method General Rules

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.

C. Room Cavity Ratio (RCR)

1. The room cavity ratio must be determined for any primary function area using the Tailored Lighting Method.
2. 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. Since luminaires are not as effective in a room with a high RCR, the Standards allow a greater LPD to compensate for this effect.
3. 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 “perimeter full height partitions” described in §140.6(c)3liv wall display.

Note: For use in calculating the RCR of the space, the walls are not required to be display walls as is required under §140-6(c) 3liv.

4. The RCR is calculated from one of the following formulas:

Equation 5-1 (Equation 140.6-F in the Standards) 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

Equation 5-2 (Equation 140.6-F in the Standards) 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

5. 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.
6. 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. **Error! Reference source not found.** gives typical RCR values calculated for rooms with the task surface at desk height (2.5 ft above the floor). This table is useful in assessing whether or not a room is likely to have an RCR greater than 2.0.
7. 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 (see example below). In stack areas the RCR is assumed to be greater than seven. The non-stack areas are treated normally.

TABLE 5- 5: Typical RCRs

For a task height of 2.5 feet above the floor								
Room Length (ft)	Room Width (ft)							
	8	12	16	20	24	30	36	40
5	8.9	7.8	7.2	6.9	6.6	6.4	6.3	6.2
8	6.9	5.7	5.2	4.8	4.6	4.4	4.2	4.1
12	5.7	4.6	4.0	3.7	3.4	3.2	3.1	3.0
16	5.2	4.0	3.4	3.1	2.9	2.6	2.5	2.4
20	4.8	3.7	3.1	2.8	2.5	2.3	2.1	2.1
24	4.6	3.4	2.9	2.5	2.3	2.1	1.9	1.8
30	4.4	3.2	2.6	2.3	2.1	1.8	1.7	1.6
36	4.2	3.1	2.5	2.1	1.9	1.7	1.5	1.5
40	4.1	3.0	2.4	2.1	1.8	1.6	1.5	1.4
When room cavity height = 5.5 feet (eight feet from floor to bottom of luminaire)								
Room Length (ft)	Room Width (ft)							
	8	12	16	20	24	30	36	40
5	12.2	10.6	9.8	9.4	9.1	8.8	8.5	8.4
8	9.4	7.8	7.0	6.6	6.3	5.9	5.7	5.6
12	7.8	6.3	5.5	5.0	4.7	4.4	4.2	4.1
16	7.0	5.5	4.7	4.2	3.9	3.6	3.4	3.3
20	6.6	5.0	4.2	3.8	3.4	3.1	2.9	2.8
24	6.3	4.7	3.9	3.4	3.1	2.8	2.6	2.5
30	5.9	4.4	3.6	3.1	2.8	2.5	2.3	2.2
36	5.7	4.2	3.4	2.9	2.6	2.3	2.1	2.0
40	5.6	4.1	3.3	2.8	2.5	2.2	2.0	1.9
When room cavity height = 7.5 feet (ten feet from floor to bottom of luminaire)								

D. Determining Allowed General Lighting Power for Tailored Method

§140-6(c)3
Standards Table 140.6-D

1. Tailored Method Trade-Off Allowances

Compliance forms shall be used to document trading-off Tailored Method Lighting Power Density allotments. Trade-offs are available only for general lighting, and only under the following circumstances:

- a. From one conditioned primary function area using the Tailored Method, to another conditioned primary function area using the Tailored Method;

- b. From one conditioned primary function area using the Tailored Method, to another conditioned primary function area using the Area Category Method;
- c. From one unconditioned primary function area using the Tailored Method, to another unconditioned primary function area using the Tailored Method;
- d. From one unconditioned primary function area using the Tailored Method, to another unconditioned primary function area using the Area Category Method.

2. Determine Lighting Power Allotments for Conditioned and Unconditioned Primary Function Areas

The allowed Tailored Method Indoor Lighting Power Density allotment for general lighting shall be separately calculated for conditioned and unconditioned primary functions are as follows:

- a. For a conditioned primary function area, multiply the conditioned square feet of that area times the applicable allotment of watts per square foot for the area shown in Table 5-6;
- b. For an unconditioned primary function area, multiply the unconditioned square feet of that area times the applicable allotment of watts per square foot for the area shown in Table 5-6.

An "area" is defined as all contiguous areas which accommodate or are associated with a single primary function area. 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.

3. Calculating Tailored Method General Lighting Power Allotments

The Standards define 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 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.

Table 5-6 or §140.6(c)3H shall be used to determine the general lighting power density allotments as follows:

a. Using Table 5-6 to Determine General Lighting Power Allotments:

- i. Find the appropriate Primary Function Area in column 1 that fits one of the Nonresidential Function Area definitions in §100.1(b);
- ii. Find the corresponding General Illumination Level (Lux) in column 2;
- iii. Determine the room cavity ratio (RCR) for that primary function area, according to the applicable equation in TABLE 5-8. Use the RCR compliance form to document the RCR calculation;

- iv. Refer to Table 5-9, using the General Illumination Level (Lux, determined according to item b), and the RCR (determined according to item c), to determine the allowed Power Density Value;
- v. Multiply the allowed Lighting Power Density Value times the square feet of the primary function areas. The product is the Allowed Indoor Lighting Power allotment for general lighting for that primary function area.

b. Using §140.6(c)3H to Determine General Lighting Power Allotments:

- i. This section shall be used to determine general lighting power density allotments only for the following primary function areas, as defined in §100.1(b):
 1. Exercise Center, Gymnasium
 2. Medical and Clinical Care
 3. Police Stations and Fire Stations
 4. Public rest areas along state and federal roadways
 5. Other primary function areas that are not listed in TABLE 140.6-D
- ii. Determine the illuminance values (Lux) for one of the primary function areas listed above as found in the Tenth Edition IES Lighting Handbook (IES HB), using the IES Recommended Horizontal Maintained Illuminance Targets for Observers 25-65 years old for illuminance;
- iii. Determine the room cavity ratio (RCR) for that primary function area, according to the applicable equation in TABLE 5-8. Use the RCR compliance form to document the RCR calculation;
- iv. Refer to Table 5-9, using the General Illumination Level (Lux, determined according to item b), and the RCR (determined according to item c), to determine the allowed Power Density Value;
- v. Multiply the allowed Lighting Power Density Value times the square feet of the primary function areas. The product is the Allowed Indoor Lighting Power Density allotment for general lighting for that primary function area.

E. Determine Additional Allowed Power for Tailored Method

§140(c)3; Standards Table 140.6-D

When using the Tailored Method for lighting compliance, in addition to the general lighting power allowance determined in accordance with Table 5-6, F, and G, additional allowed lighting power is available for wall display, floor display, task, ornamental/special effects, and very valuable display case lighting.

These additional layers of lighting power are not available when using §140.6(c)3H 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 shall not be traded-off. That is, if the installed watts are less than the allowed watts, the difference in watts is not available to trade-offs anywhere else in the building.

1. Additional Wall Display Lighting Power:

- a. Wall display lighting is defined by the Standards as supplementary lighting required to highlight features such as merchandise on a shelf, which is displayed on perimeter walls; and that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance.
- b. Additional allowed power for wall display lighting is available only for lighting that illuminates walls having wall displays, only when there is a watts per linear foot allowance in column 3 of Table 5-6 for the primary function area.
- c. The wall display lighting power is NOT available for the following:
 - i. When using §140.6(c)3H for determining the Allowed Indoor Lighting Power Density allotment for general lighting for the area.
 - ii. For any function areas using the Complete Building or Area Category methods of compliance.
 - iii. Floor displays shall not qualify for wall display lighting power allowances.
- d. To qualify for the additional wall display lighting power, the lighting system shall be a type that is appropriate for creating a higher level of illuminance on the wall display.
 - i. Lighting systems appropriate for wall 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 other directional lamp types.)
 - ii. General lighting systems shall not qualify for this allowance.
- e. Qualifying wall display lighting shall be mounted within 10 feet of the wall having the wall display.
 - i. When track lighting is used for wall display, and where portions of that lighting track are more than 10 feet from the wall and other portions are within 10 feet of the wall, only those portions of track within 10 feet from the wall shall qualify for the wall display allowance.
- f. 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.
 - i. Permanent full height interior partitions are those that meet the following conditions:
 - Extend from the floor to no more than two feet below the ceiling or are taller than ten feet, and

- Are permanently anchored to the floor, provided that neither commercial industrial stacks nor industrial storage stacks are permanent full height interior partitions.
- g. Column 3 of Table 5-6 shall be used to determine the additional allowed power for wall display lighting as follows:
- i. Use the same Primary Function Area Category row in column 1 that was used to determine the general lighting power density allotments for the area;
 - ii. Find the corresponding Wall Display Power (W/linear ft) in column 3;
 - iii. Determine the length of qualifying display walls in a single room or area;
 - iv. Multiply the Wall Display Power times the length of qualifying display walls, to calculate Wall Display lighting power allowance.
- h. A mounting height multiplier is available in Table 5-7 for wall display luminaires mounted 12 feet or higher, where mounting height is the distance from the finished floor to the bottom of the luminaire.
- i. The mounting height multiplier is NOT available for the general lighting power density allotment.
 - ii. The mounting height multiplier in Table 5-7 shall be used inversely to reduce the input wattage of luminaires (adjusted input wattage).
 - iii. Wall display lighting with varying mounting heights shall be separately determined.

In a single room, or single area having wall display lighting, using § 130.0(c) to determine luminaire classification and input wattage, do the following:

- Separately add together the input wattage of all wall display luminaires mounted lower than 12 feet. These luminaires do not qualify for a height multiplier.
- Separately add together the input wattage of all wall display luminaires mounted between 12 feet to lower than 16 feet. Multiply the total input wattage of these luminaires times 0.85. This will be your adjusted input wattage for these luminaires.
- Separately add together the input wattage of all wall display luminaires mounted higher than 16 feet. Multiply the total input wattage of these luminaires times 0.70. This will be your adjusted input wattage for these luminaires.

- i. The additional allowed power for wall display lighting shall be the smaller of the calculated Wall Display Power allowance, or the sum total of the adjusted input wattage of all luminaires used for the wall display lighting systems in that room or area. Use the smaller as follows:
 1. The additional allowed power for wall display lighting determined in accordance with Column 3 of Table 5-6, or
 2. The sum total of:
 - Sum total input wattage of all wall display luminaires mounted lower than 12 feet, plus
 - Sum total adjusted input wattage of all wall display luminaires mounted 12 feet to lower than 16 feet, plus
 - Sum total adjusted input wattage of all wall display luminaires mounted 16 feet or higher.
- j. Use the appropriate compliance forms to document the additional allowed power for wall display lighting.

2. Additional Floor Display and Task Lighting Power:

- a. Floor display lighting is defined by the Standards as supplementary lighting required to highlight features, such as merchandise on a clothing rack, which is not displayed against a wall; and provides a higher level of illuminance to this specific area than the level of surrounding ambient illuminance.
- b. Task Lighting is defined by the Standards as lighting that is not general lighting and that specifically illuminates a location where a task is performed.
- c. 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, only when there is a watts per square foot allowance in column 4 of Table 5-6 for the primary function area.
- d. 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.
- e. Additional allowed power for a combination of floor display lighting and task lighting shall be available only for:
 - i. Floors having floor displays; or
 - ii. Floors not having floor displays but having tasks having illuminance recommendations that appear in the Tenth Edition of

the IES Lighting Handbook and that are higher than the general lighting level in column 2 of Table 5-6.

- f. Floor display and task lighting shall be separately switched from the general lighting system.
- g. The additional power for floor display and task lighting are NOT available for the following:
 - i. When using §140.6(c)3H for determining the Allowed Indoor Lighting Power Density allotment for general lighting for the area.
 - ii. For any function areas using the Complete Building or Area Category methods of compliance.
 - iii. Displays that are installed against a wall shall not qualify for the floor display lighting power allowances.
 - iv. 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.
- h. Lighting internal to display cases shall be counted either as floor display lighting in accordance with §140.6(c)3J; or as very valuable display case lighting in accordance with §140.6(c)3Liii and iv.
- i. 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. Floor display and task lighting shall be of a type different from the general lighting system.
 - i. Lighting systems appropriate for floor display and task lighting consist of only directional lighting types, such as PAR, R, MR, AR; or of lighting employing optics providing directional display light from non-directional lamps.
 - ii. If track lighting is used, only track heads that are classified as directional lighting types qualify
- j. Qualifying floor display lighting shall be mounted no closer than 2 feet to a wall, and shall be located immediately adjacent to and capable of illuminating the task for which it is installed.
 - i. When track lighting is used for floor or task 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 and task lighting power allowance.
- k. Column 4 of Table 5-6 shall be used to determine the additional allowed power for floor display and task lighting as follows:

- i. Use the same Primary Function Area Category row in column 1 that was used to determine the general lighting power density allotments for the area;
 - ii. Find the corresponding Allowed Combined Floor Display Power and Task Lighting Power (W/ft²) in column 4;
 - iii. Determine the square feet of the qualifying area.
 - iv. Multiply the Allowed Combined Floor Display Power and Task Lighting Power Floor Display/Task Lighting Power allowance.
- I. A mounting height multiplier is available in Table 5-7 for floor display and task luminaires mounted 12 feet or higher, where mounting height is the distance from the finished floor to the bottom of the luminaire.
- iv. The mounting height multiplier is NOT available for the general lighting power density allotment.
 - v. The mounting height multiplier in Table 5-7 shall be used inversely to reduce the input wattage of luminaires (adjusted input wattage),
 - vi. Floor display lighting and task lighting luminaires with varying mounting heights shall be separately determined.

In a single room having floor display lighting and/or task lighting luminaires, using § 130.0(c) to determine luminaire classification and input wattage, do the following:

- Separately add together the input wattage of all floor display lighting and task lighting luminaires mounted lower than 12 feet. These luminaires do not qualify for a height multiplier.
 - Separately add together the input wattage of all floor display lighting and task lighting luminaires mounted between 12 feet to lower than 16 feet. Multiply the total input wattage of these luminaires times 0.85. This will be your adjusted input wattage for these luminaires.
 - Separately add together the input wattage of all floor display lighting and task lighting luminaires mounted higher than 16 feet. Multiply the total input wattage of these luminaires times 0.70. This will be your adjusted input wattage for these luminaires.
- m. The additional allowed power for all floor display lighting and task lighting luminaires lighting shall be the smaller of the calculated Floor Display/Task Lighting Power allowance, or the sum total of the adjusted input wattage of all luminaires used for floor display and task lighting systems in that room or area, using the smaller of the following:

1. The additional allowed power for wall display lighting determined in accordance with Column 3 of Table 5-6, or
2. The sum total of:
 - Sum total input wattage of all floor display luminaires and task lighting luminaires mounted lower than 12 feet, plus
 - Sum total of adjusted input wattage of all floor display luminaires and task lighting luminaires mounted from 12 feet to lower than 16 feet, plus
 - Sum total adjusted input wattage of all floor display luminaires and task lighting luminaires mounted 16 feet or higher.
- Use the appropriate compliance form to document the additional allowed power for Floor Display/Task Lighting Power lighting.

3. Additional Ornamental/Special Effects Lighting Power:

- a. Indoor ornamental lighting is defined in §100.1(b) as decorative luminaires that are chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights, and light-color panels. Additionally, §140.6(c)3K(ii) further defines qualifying ornamental lighting to include 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.
- b. Special effects lighting is defined as lighting installed to give off luminance instead of providing illuminance.
- c. Additional allowed power for ornamental/special effects lighting may be used only for qualifying ornamental lighting systems, qualifying special effects lighting systems, or a combination of both, only when there is a watts per square foot allowance in column 5 of Table 5-6 for the primary function area.
- d. The wall display lighting power is NOT available for the following:
 - i. When using §140.6(c)3H for determining the Allowed Indoor Lighting Power Density allotment for general lighting for the area.
 - ii. For any function areas using the Complete Building or Area Category methods of compliance.
- e. For floor areas qualifying for both ornamental and special effects 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.

- f. Any floor area not designed have ornamental or special effects lighting shall not be included for the ornamental/special effects lighting allowance.
 - g. Column 5 of Table 5-6 shall be used to determine the additional allowed power for ornamental/special effects lighting as follows:
 - i. Use the same Primary Function Area Category row in column 1 that was used to determine the general lighting power density allotments for the area;
 - ii. Find the corresponding Allowed Ornamental/Special Effects Lighting Power (W/ft²) in column 5;
 - iii. Determine the square feet of the qualifying area:
 - iv. Multiply the Allowed Ornamental/Special Effects Lighting Power, times the square feet of the qualifying area, to determine calculated Allowed Ornamental/Special Effects Lighting Power allowance.
 - h. A mounting height multiplier is NOT available for ornamental/special effects lighting.
 - i. The additional allowed power for Ornamental/Special Effects Lighting shall be the smaller of the calculated Allowed Ornamental/Special Effects Lighting Power allowance, or the actual power used for the Allowed Ornamental/Special Effects Lighting systems;
 - j. Use the appropriate compliance form to document the additional allowed power for Ornamental/Special Effects Lighting.
- 4. Additional Very Valuable Display Case Lighting Power:**
- a. Case lighting is defined in the Standards as lighting of small art objects, artifacts, or valuable collections which involves customer inspection of very fine detail from outside of a glass enclosed display case.
 - b. 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 of a locked case.
 - c. Additional allowed power for very valuable display case lighting shall be available only for display cases in retail merchandise sales, museum, and religious worship areas.
 - d. 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.
 - e. Any floor area designed to not have very valuable display case lighting shall not be included for the very valuable display case lighting allowance.

- f. The valuable display case lighting power is NOT available for the following:
 - i. When using §140.6(c)3H for determining the Allowed Indoor Lighting Power Density allotment for general lighting for the area.
 - ii. For any function areas using the Complete Building or Area Category methods of compliance.
- g. A mounting height multiplier is NOT available for very valuable display case lighting.
- h. The very valuable display case lighting allowance shall be the smallest of the following:
 - i. The product of the area of the primary function and 0.8 watt per square foot; or
 - ii. The product of the area of the display case and 12 watts per square foot; or
 - iii. The actual power of lighting for very valuable displays.
- i. Use the appropriate compliance form to document the additional allowed power for valuable display case lighting.

**TABLE 5- 6: (table 140.6-D in the Standards)
Tailored Method Lighting Power Allowances**

1	2	3	4	5
Primary Function Area	General Illumination Level (Lux)	Wall Display Power (W/ft)	Allowed Combined Floor Display Power and Task Lighting Power (W/ft ²)	Allowed Ornamental/ Special Effect Lighting
Auditorium Area	300	2.25	0.3	0.5
Civic Meeting Place	300	3.15	0.2	0.5
Convention, Conference, Multipurpose, and Meeting Center Areas	300	2.50	0.4	0.5
Dining Areas	200	1.50	0.6	0.5
Exhibit, Museum Areas	150	15.0	1.2	0.5
Financial Transaction Area	300	3.15	0.2	0.5
Grocery Store Area	500	8.00	0.9	0.5
Hotel Function Area	400	2.25	0.2	0.5
Lobby Area:				
Hotel lobby	200	3.15	0.2	0.5
Main entry lobby	200	0	0.2	0
Lounge Area	200	7.00	0	0.5
Malls and Atria	300	3.50	0.5	0.5
Religious Worship Area	300	1.50	0.5	0.5
Retail Merchandise Sales, and Showroom Areas	400	14.00	1.0	0.5
Theater Area:				
Motion picture	200	3.00	0	0.5
Performance	200	6.00	0	0.5
Transportation Function Area	300	3.15	0.3	0.5
Waiting Area	300	3.15	0.2	0.5

**TABLE 5- 7: (Table 140.6-E in the Standards)
Adjustments for Mounting Height Above Floor**

Height in feet above finished floor and bottom of luminaire(s)	Floor Display or Wall Display – Multiply by
< 12'	1.00
12' to 16'	1.15
> 16'	1.30

**TABLE 5- 8: (Table 140.6-F in the Standards)
Room Cavity Ratio (RCR) Equations**

Determine the Room Cavity Ratio for TABLE 5-9 using one of the following equations.
Room cavity ratio for rectangular rooms $RCR = \frac{5 \times H \times (L + W)}{L \times W}$
Room cavity ratio for irregular-shaped rooms $RCR = \frac{2.5 \times H \times P}{A}$
Where: L =Length of room; W = Width of room; H =Vertical distance from the work plane to the centerline of the lighting fixture; P = Perimeter of room, and A = Area of room

**TABLE 5- 9: (Table 140.6-G in the Standards)
Illuminance Level (LUX) Power Density Values (Watts/Ft²)**

Illuminance Level (Lux)	RCR ≤ 2.0	RCR > 2.0 and ≤ 3.5	RCR > 3.5 and ≤ 7.0	RCR > 7.0
50	0.2	0.3	0.4	0.6
100	0.4	0.6	0.8	1.2
200	0.6	0.8	1.3	1.9
300	0.8	1.0	1.4	2.0
400	0.9	1.1	1.5	2.2
500	1.0	1.2	1.6	2.4
600	1.2	1.4	2.0	2.9
700	1.4	1.7	2.3	3.3
800	1.6	1.9	2.6	3.8
900	1.8	2.2	3.0	4.3
1000	1.9	2.4	3.3	4.8

Example 5-20 Room Cavity Ratio

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

$RCR = 5 \times H \times (L + W) / \text{Area}$

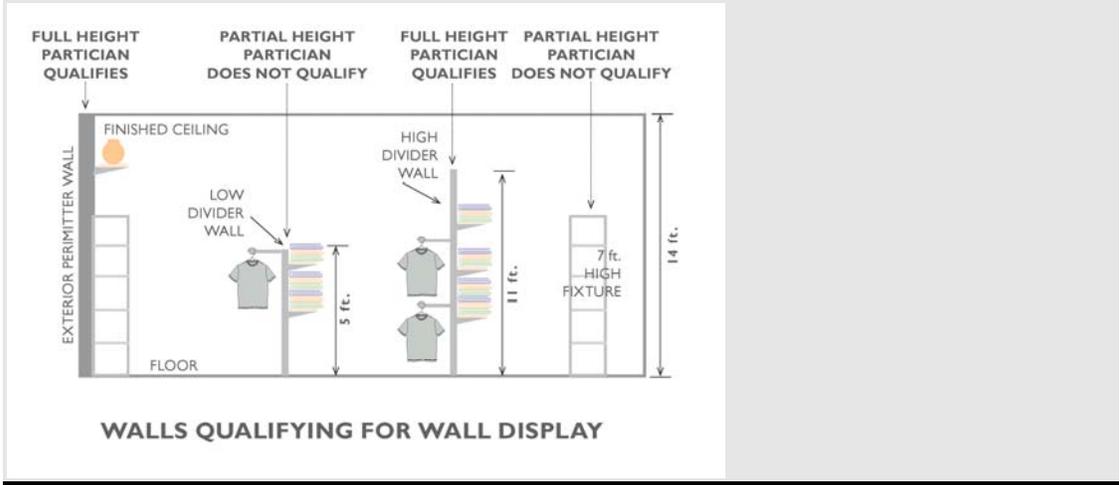
$RCR = 5 \times 5.5 (14+20) / (14 \times 20) = 3.34$

Example 5-21 Retail space lighting allocation

Question

A large retail store with a sales area that has a 14 ft 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” partitions (per §140.6(c)3iv), which components qualify for the wall display allocation?

Answer

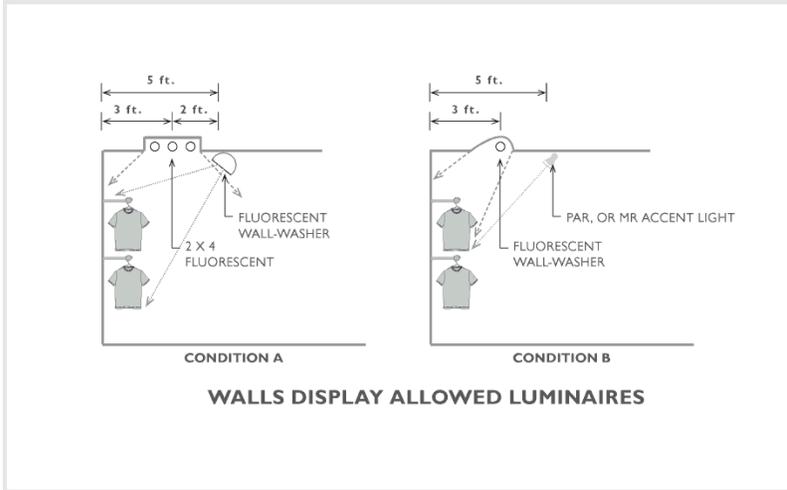


Example 5-22 Wall display lighting

Question

In this question, condition A has 2X4 troffers placed 3 ft from a perimeter sales wall as well as fluorescent wall-washers 5 ft from the sales wall. Condition B has fluorescent wall-washers 3 ft from the wall and PAR adjustable accent lights 5 ft from the wall. Which luminaires qualify for the wall display lighting allocation?

Answers



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

CONDITION A

While both luminaires are within ten feet of the wall only the wall-washer qualifies for the wall display allocation. The 2X4 is a general lighting luminaire with symmetric versus asymmetric distribution and does not qualify for the allocation.

CONDITION B

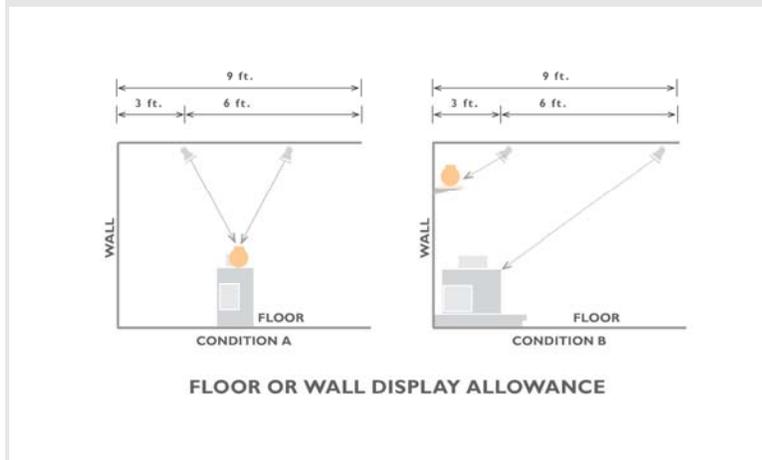
Both luminaires are within ten feet of the wall and both qualify for the wall display allocation. The fluorescent wall-washer has an asymmetric distribution and the PAR accent light at 5 ft from the wall is directional and is lamped with a projector lamp.

Example 5-23 Museum lighting allocation

Question

A museum space has directional accent lighting luminaires on track mounted to the ceiling. The first track is three feet from the perimeter wall of the exhibit space and the second track is nine feet from the wall. There is a third track (not shown) that is fifteen feet into the space. To what display category should these luminaires be assigned under §140.6(c) 3I and 3J

Answers



Per §140.6(c)3Iiv & 3Jv wall display luminaires must be within 10 ft of the wall and directional and floor displays must be at least two feet away from the wall and also directional. Using these criteria, the allocations for the two conditions shown are as follows:

CONDITION A

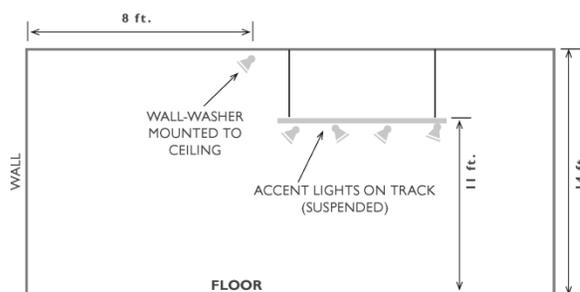
Both sets of luminaires shown are at least 2 ft away from the wall and are directed onto a floor exhibit (display) therefore they both qualify for the floor display allocation. The third track with directional luminaires also qualifies as floor display.

CONDITION B

Both sets of luminaires shown are also closer than 10 ft to the wall and are directed onto a wall exhibit (display) therefore they both, when directed toward the wall qualify for the wall display allocation. The third track with directional luminaire (15 ft from the wall) does not qualify for wall display, only floor display.

Note: Luminaires within a 2 ft to 10 ft zone may be assigned to either wall or floor display depending on the focus direction of the luminaires. However only one classification, either wall or floor can be used for luminaire compliance, not both.

Example 5-24 Ceiling height adjustments



**ALLOWED THROW DISTANCE FACTOR
(DISPLAY LIGHTING)**

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 18 ft high ceiling, does the display lighting qualify for a mounting height factor adjustment?

Answer

Per §140.6(c) 3Iv and 3Jix, some but not all of the display lighting qualifies for the mounting height adjustment. The wall directional lighting that mounted at the ceiling is above 12 ft which then qualifies it for an adjustment factor of 1.15 in accordance with **Error! Reference source not found.** (Table 140.6-E in the Standards). However the track that is suspended at 11 ft is excluded from an adjustment factor. It must use the default factor of 1 with the allowed LPD as shown in column 4 in

(Table 140.6-E in the Standards)

Example 5-25 Tailored compliance lighting power allowance

Question

The customer area of a branch bank includes financial transaction counters, wall displays and seating. The size of the space is 20 ft wide by 50 ft long and 11 ft high. Transaction counters are 3-feet off the floor and there is 80 ft of wall display. Lighting used is recessed down lights and wall-washer luminaires. Under Tailored Compliance, what is the maximum allowed LPD (excluding any control credits)?

Answer

From Table 5-6 (Lighting Standards), target general illumination is 300 lux. Using the dimensions given (20 ft X 50 ft X 11 ft and a task height of 3-feet the room cavity ratio (RCR) is calculated to = 2.8. Using Table 5-9, the 300 lux target is allowed 1.0 W in a space with an RCR of > 2.0 and < 3.5. Therefore, at 20 ft X 50 ft x 1.0 the general lighting allowance is 1000W. In addition, per Table 140,6-D, column 3 the 75 ft of wall display is allowed. 3.15 W per lineal foot which is 236 W and the transaction task from column 4 is allowed 0.2W square foot or 200 W. Total allowed watts for this financial transaction area is 1000W + 236W + 200W which =1436W (or 1.44 W/ft²)

Example 5-26 Tailored compliance lighting power allowance

Question

If, in the previous question, the design used only down lights or 2X2 fluorescent troffers, what is the maximum allowed power (*excluding any control credits*)?

Answer

1200W (or 1.2 W/ft²)

The 1200W comprises 1000W for the allowed general lighting and 200 watts for the task lighting. The wall display lighting cannot be applied as there are no qualifying luminaires in the design. Display lighting is a use-it-loose-it component and the lighting equipment used must meet the optical characteristics of display and focal lighting. 2X2 general luminaires do not qualify.

Example 5-26 Tailored compliance with decorative lighting**Question**

The bank from the previous question wants to add chandeliers in addition to down lights and wall-washers. What is the maximum allowed power under Tailored compliance (*excluding any control credits*)?

Answer

1936 W (or 1.94 W/ft²)

In addition to the 1436 W allowed for the combination of general lighting display lighting and task lighting, a maximum of 500 W (per Table 5-6 column 5) of Ornamental/Special effects lighting such decorative luminaires is allowed. Note: for this wattage to be allowed the decorative lighting must be in addition to general lighting and the luminaire must meet the ornamental lighting criteria. The actual allowed Ornamental light LPD will be the lower of the maximum allowed or total decorative luminaire watt.

Example 4-28 Tailored Method lighting calculation**Question**

A 5,500-ft² retail store has:

5,000 ft² of gross sales floor area.

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 actual lighting.

There are 300 linear ft of perimeter wall including closeable openings and Ornamental/special effects lighting is being used as part of the retail scheme.

What are the allowed general lighting, wall display, floor display, ornamental/special effect, and very valuable display wattage in this store using the Tailored Method?

Answer

From Standards Table 140.6-D, the general illumination for retail is 400 Lux. From Standards Table 140.6-G, the LPD for 400 Lux in a space with an RCR of 2.5 is 1.1 W/ft². Therefore, the allowed general lighting power is 1.1 w/ft² X 5,000 ft² = **5500W**.

Restrooms are not included in Tailored compliance. Therefore the allowed LPD is as defined in the Area Category Table 5-4 (Table 140.6-C of the standards). Table 5-4 allows 0.6W for restrooms. The allowed power for the restrooms is 200 ft² x 0.6 W/ft² = **120 W**. (*There is no RCR factor or RCR table for area compliance.*)

Corridors also are not included in Tailored compliance, therefore the allowed LPD is as defined in the Area Category Table 5-4. Table 5-4 allows 0.6W for corridors. The allowed power is $300 \text{ ft}^2 \times 0.6 \text{ W/ft}^2 = \mathbf{180 \text{ W}}$. (There is no RCR factor or RCR table for Area Category Method compliance.)

The wall display lighting is computed from the entire wall perimeter including all closeable openings times the wall display power allowance. Therefore, the allowed wattage is $300 \text{ ft} \times 14 \text{ W/ft} = \mathbf{4,200\text{W}}$. The allowance is taken from column three of Standards Table 140.6-D.

The floor display allowance is computed from the area of the entire space with floor displays times the floor display lighting power density. Therefore, the allowed wattage is $5,000 \text{ ft}^2 \times 1.0 \text{ W/ft}^2 = \mathbf{5,000\text{W}}$. The allowance is taken from column four of 140.6-D in the Standards.

The ornamental/special effect allowance is computed from the area of the entire space with floor displays times the ornamental/special effect lighting power density. Therefore, the allowed wattage is $5,000 \text{ ft}^2 \times 0.5 \text{ W/ft}^2 = \mathbf{2,500 \text{ W}}$. The allowance is taken from column five of 140.6-D in the Standards.

The allowed wattage for very valuable display case top is smaller of the product of 0.8 W/ft^2 and the gross sales area ($5,000 \text{ ft}^2$) or the product of 14 W/ft^2 and the actual area of the case tops (100 ft^2). The maximum allowed power is the smaller of $0.8 \text{ W/ft}^2 \times 5,000 \text{ ft}^2 = 4,000$ watts, or $14 \text{ W/ft}^2 \times 100 \text{ ft}^2 = 1,200$ watts. Therefore, the maximum allowed power is **1,200 W**.

Therefore, the total allowed lighting wattage is $5,500 + 120 + 180 + 4,200 + 5,000 + 2,500 + 1,200 = \mathbf{18,700 \text{ W}}$. Note that in 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 Tailored compliance is tradable between areas using tailored compliance or areas using Area compliance..

Example 5-29 Valuable display power allowance

Question

If in the question above, the actual design wattages for floor display and very valuable display are 4,500 W and 1,000 W respectively, what are the maximum allowed floor display and very valuable display power allowances?

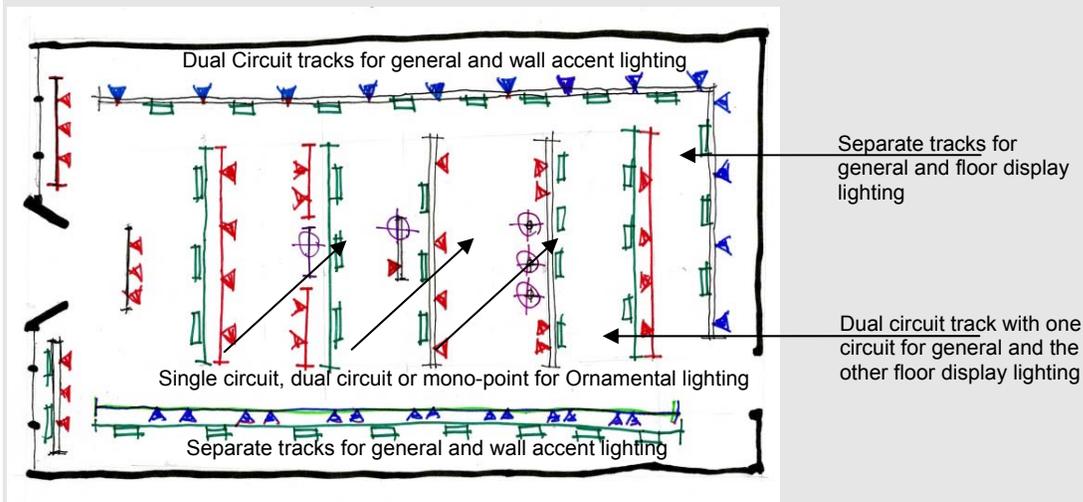
Answer

Since the floor display and very valuable display allowances are use-it-or-lose-it allowances, the maximum power allowed is the smaller of allowed watts for floor display (5,000 W) and very valuable display (1,200 W) or the actual design watts for floor display (4,500 W) and very valuable display (1,000 W). Therefore, the maximum allowed watts for floor display and very valuable display are 4,500 W and 1,000 W actual design watts, not 5,000 W and 1,400 W maximum allowed watts.

Example 5-30 Maximum power allowance for tailored compliance

Question (Two Parts)

Owners of a retail store want to use track lights for all the sales floor lighting. The shops selling floor is 50 ft x 100 ft with 10 ft high ceilings. There are 125 ft of sales wall and decorative pendants for ornamental effect lighting also mounted on track. All the merchandise is on open sell racks, tables or on wall shelves and hangers. There will be no casework or high-end valuable merchandise lighting required in the design. **Part one:** using tailored compliance, what is the maximum allowed lighting power? **Part two:** based on the design description, what other compliance requirements are unique to this approach?



Answer – Part 1

The allowed maximum wattage is **13,750W** or LPD is 2.75W/ft² which is determined as follows:

From Standards Table 140.6-D, Column 2, the general illumination for retail is 400 lux. From Standards Table 5-9, the LPD for 400 lux in a space with the RCR determined as <2.0 is 0.9W/ft². Therefore, the allowed general lighting power is 0.9W/ft² X 5,000 ft² = 4500W along with the allowed floor display lighting from table 140.6-D column 4 which is 1.0W/ft² X 5,000 ft² = 5000W and the allowed wall display lighting from the same table column 3 which is 14W/ft X 125 ft = 1750W. Plus an ornamental lighting adder from column 5 of 0.5 W/ft² X 5,000 ft² = 2500W [4500 + 5000 + 1750 + 2500 = 13,750]

Answer – Part 2

Dual circuit track, multiple independently circuited tracks or combination of both will be required for an all track design to conform to Title 24-2013 Tailored lighting compliance.

Retail stores or other spaces using Tailored Compliance that use track lighting exclusively for the layered lighting approach as defined in the Tailored Method must provide a system for separately switching and controlling the layered lighting components (general, floor display, wall display and ornamental lighting). One solution is the use of dual circuit track with one circuit dedicated to general lighting and the other to wall display or floor display, based on where the track is located and on its assigned function. If/when ornamental lighting is also powered by track; it must also be separately circuited using dual circuit track or a separate dedicated track.

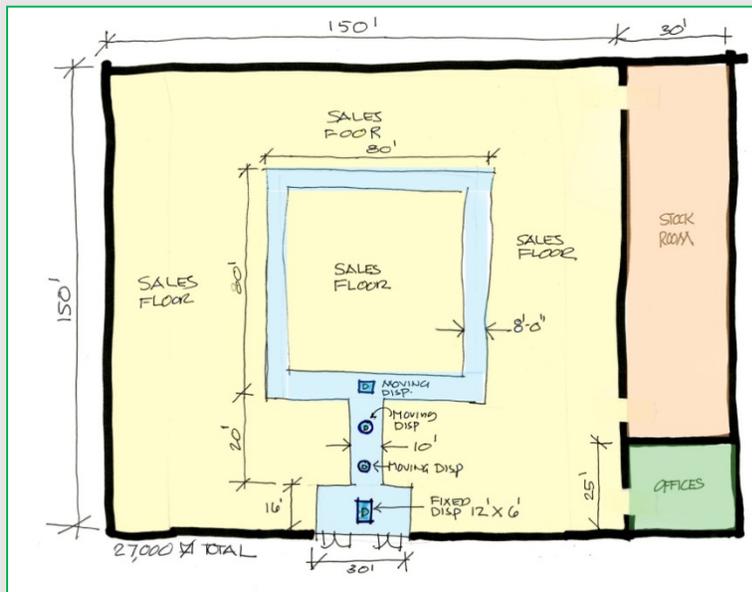
Another solution is to use multiple, single circuit tracks, as needed, with each track circuited for its specific task (general, display or ornamental lighting).

Note: each lighting task; general, display and/or ornamental lighting must be separately circuited and controlled. Therefore, in an application that has an area with general lighting, wall and floor display and ornamental lighting all occurring multiple adjacent dual circuit tracks or a combination of tracks and other power connections (such as mono-points) may be needed.

Example 5-31 Tailored compliance LPD for retail space

Question

How are the task spaces and allowed LPD’s determined for a 27,000 square foot retail store with sales areas, stockrooms and offices using Tailored Compliance?



Answer

Determine square footage allowances by space type, as well as allowed maximum watts, for each area as follows:

1) Identify spaces allowed Tailored Method compliance and those requiring Area Method. Only the sales area can use Tailored Compliance (per table 140.6-D of the standards) stock rooms and offices are not in the tailored tables and therefore must comply under the area method (Table 5-4).

2). Square footage of offices and stockrooms are determined by multiplying the length and width of each space (25 X 30 = **750 ft²** for offices) (30 X 125 = **3750ft²** for stockrooms). The allowed maximum watts for offices and stockrooms are then determined by multiplying the allowed LPD of the space (Table 140.6-C of the Standards) by the area of the space.

3) Sales floor uses the total area as was used for offices and stock rooms. However the gross sales area also includes major circulation paths that are required by code (evacuation egress). Therefore these egress areas must be deducted from the total sales floor footprint to determine allowed sales area when using Tailored Compliance. Note: the same is also true for a sales area complying under the area method. Allowed sales floor square footage is therefore **19,980 ft²** (150 X 150 = 22500 minus 2520 total egress area shown in pale blue on plan).

To determine maximum allowed watts for the sales floor it is also necessary to identify the lineal foot of qualifying walls eligible for wall display. Total maximum watts for the sales floor is then determined by using the allowed LPD for general lighting based on the RCR of the space and the LPD (columns 2, 3 & 4 from Table 5-6 and Table 5-9 of the standards) for allowed floor display, wall display and ornamental effect lighting.

4) LPD for the 2,520 ft² of egress space is determined by using area compliance, as it is not a category shown under allowed tailored compliance (Table 140.6-D of the Standards). Table - 140.6-C of the Area Method will determine the allowed LPD as egress space falls under the category of circulation. Multiply the LPD for circulation by the egress area for the allowed maximum watts.

Example 5-32 Tailored compliance for exercise center

Question

Using provisions as defined under §140.6(c)3H Tailored Compliance, what is the Allowed Lighting Power for an Exercise Center with two separate rooms? One room is 40ft wide X 60 ft long with a 16 ft ceiling. The other room is 16ft wide X 30 ft long with a 12ft ceiling. The luminaires are mounted at the ceiling for both rooms.

Answer

3,180 W total for the two room Exercise Center. This allowed wattage is determined by:

1) Illuminance values (Lux) for an Exercise Center according to the IESNA Lighting Handbook Tenth Edition using the horizontal illuminance targets for observers in the 25-65 age bracket. From the handbook, the horizontal illumination target is determined to be a maximum of **400 lux** measured at 4 to 5 ft above the floor.

2) The RCR in accordance with Equation 4-7 (Table 5-8 of the Standards). Since there are two different rooms, each will need to have its RCR determined.

a) The RCR for the 40' X 60" with 16" ceiling has an RCR of **2.4** ($5 \times 12 \times 100 \div 2400 = 2.4$)

b) The RCR for the 16' X 30" with 12" ceiling has an RCR of **3.83** ($5 \times 8 \times 46 \div 480 = 3.83$)

3) The allowed lighting power density (LPD) in Table 4-7 (Table 140.6-G of the Standards)

a) The first room with an RCR of 2.4 and a lux Target of 400 is allowed 1.1 W/ft²

b) The second room with an RCR of 3.83 (and target of 400 Lux is allowed 1.5 W/ft²)

4) The square feet of the areas; One room is 40 feet wide X 60 feet long = 2400 feet and the other 16' X 30" = 480 feet. Therefore the allowed watts are as follows:

a) $2400 \times 1.1 = 2,640 \text{ W}$

b) $480 \times 1.5 = 720 \text{ W}$

5) The total allowed lighting power in watts is 2640W + 720W or a total of **3,180W** for the two room Exercise Center.

Example 5-33 Tailored compliance for decorative lighting in exercise center

Question

Using provisions as defined under §140.6(c)3H Tailored Compliance what is the Allowed Lighting Power for the Exercise Center if a portion of the lighting will use decorative chandeliers?

Answer

3,180W total for the two room Exercise Center using the same procedure as outlined in Example 4032 above.

Although some of the lighting is being created with use of decorative chandeliers, Table 5-6 column 5 doesn't apply when using §140.6(c)3H Tailored Compliance.

A provision of §140.6(c)3H requires that when calculating allowed indoor Lighting Power Density allotments for general lighting using §140.6(c)3H, the building shall not add additional lighting power allowances for any other use, including but not limited to wall display, floor display and task, ornamental/special effects, and very valuable display case lighting.

5.8 Performance Approach

The performance approach provides an alternative method to the prescriptive approach for establishing the allowed lighting power for the building.

Under the performance approach, the energy use of the building is modeled using a compliance software program approved by the Energy Commission. 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 rules 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.

When tailored lighting is used to justify increases in the lighting load, a lower lighting load cannot be modeled for credit. The standard design building uses the lesser of allowed W/ft^2 , or actual lighting power, to be installed in the building. The proposed design building uses the actual lighting power to be installed as detailed on the lighting plans. This value must be equal to, or greater than the allowed W/ft^2 .

5.9 Additions and Alterations

5.9.1 Summary

New additions must meet the all mandatory measures for both 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, the lighting power densities may be traded-off against other prescriptive building features.

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

Lighting system alterations include modifications to lighting systems such as luminaire replacement, luminaire removal or relocation, and other similar modifications not considered to be modifications-in-place

Wiring alterations such as replacing or installing new wiring that connects the luminaires to switches, relays, branch circuits, and other control devices represents a lighting alteration and therefore must meet the applicable mandatory requirements as described below.

Luminaire Modifications-in-Place include lamp and ballast change-outs, reflector or optical system modifications, whole fixture retrofit kits, and similar modifications.

5.9.2 Additions

§141.0(a)

The nonresidential indoor lighting of the addition shall meet the applicable prescriptive lighting requirements of §119.0, §130.0 through §130.5, §140.3(c), and §140.6; or the performance requirements in §140.1.

When using the Performance approach, the indoor lighting in the addition shall meet the applicable requirements of §110.0 through §130.5; and shall meet one of the following two options:

1. The addition alone shall comply with §140.1; or
2. Meet the performance requirements for the existing building plus the addition plus the alteration.

5.9.3 Alterations – General Information

§141.0(b)2iii

A. Scope

Alterations to existing nonresidential, high-rise residential, or hotel/motel buildings, re-locatable public school buildings; or alterations in conjunction with a change in building occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy; shall meet the following requirements:

1. Comply with the requirements for Additions, or
2. Comply with the Prescriptive lighting requirements, or
3. Comply with the Performance approach:

An Alteration is defined by the Standards as follows:

1. Any change to a building's water-heating system, space-conditioning system, lighting system, or envelope that is not an addition; and
2. Any change that is regulated by Part 6 to an outdoor lighting system that is not an addition; and
3. Any change that is regulated by Part 6 to signs located either indoors or outdoors.

An Altered Component is defined by the Standards as a component that has undergone an alteration and is subject to all applicable Standards requirements.

B. Indoor Lighting Exceptions

The following indoor lighting alterations are not required to comply with the lighting requirements in Title 24, Part 6:

1. Replacement in kind of parts of an existing luminaire that include only new lamps, lamp holders, or lenses, when replacement of those parts is not a Luminaire-Modification-in-Place in accordance with § 141.0 (b) 2 I (iii).
2. Lighting Alterations directly caused by the disturbance of asbestos.
 - EXCEPTION: Lighting alterations made in conjunction with asbestos abatement shall comply with the applicable requirements in § 141.0 (b) 2 I.

C. 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 multi-level requirements in § 130.1(d).

D. Luminaire Classification and Power

1. Luminaire classification and luminaire power shall be determined in accordance with §130.0(c). See section 5.2.4 of this chapter for information on luminaire classification and power.
2. For all newly constructed buildings, for all additions, and for most other applications, the Standards do not recognize the modification of a luminaire from one lighting technology to another. However, there are limited exceptions to this general rule for some lighting alterations.

For only a Lighting System Alteration or a Luminaire Modification-in-Place, in accordance with §141.0(b)2I; an existing incandescent, fluorescent, or HID luminaire may be modified and classified as a luminaire having a different number of, or type of light source(s), provided all of the following conditions are met:

- i. The luminaire has been previously used and is in an existing installation; and,

- ii. The modified luminaire is listed with the different number or type of light source(s) under the installed conditions; and
- iii. The different light source(s) is not an LED lamp, integrated or non integrated type, as defined by ANI/IES RP-16-2010; and
- iv. The modified luminaire does NOT contain:
 - a. Unused fluorescent or HID ballast(s); or
 - b. Unused fluorescent or HID lamp sockets; or
 - c. Sockets used only for lamp support; or
 - d. Screw sockets of any kind or for any purpose; and
- v. The wattage of the modified luminaire shall be published in the manufacturer's catalog based on accredited testing lab reports.

3. Non-Title 24 Lighting Alterations

The Standards clarify in §130.0(c) that there are a number of luminaire modifications that shall not be recognized for compliance with the Standards.

One popular non-regulated and non-recognized product is the screw-based LED retrofit kit, designed to be installed directly into a recessed downlight having an incandescent socket.

Therefore, alterations that solely use one of these methods are not recognized as an alteration and as a result are not recognized as a luminaire modification in place and do not require showing Title 24 compliance. However, once compliance with the lighting alteration Standards is required, these alteration methods are not recognized for compliance. (i.e. the wattage of a recessed downlight is the rated wattage of its socket and is not reduced to the wattage of a screw-in LED retrofit kit).

The following shall not be recognized for compliance with the Standards:

- a. Luminaires and luminaire housings designed to accommodate a variety of trims or modular components that allow conversion between incandescent and any other lighting technology without changing the luminaire housing shall be classified as incandescent.
- b. Screw-based adaptors shall not be used to convert an incandescent luminaire to any type of non-incandescent technology. Screw-based adaptors, including screw-base adaptors classified as permanent by the manufacturer, shall not be recognized for compliance with Part 6.

- c. Replacement of lamps in a luminaire manufactured or rated for use with linear fluorescent lamps, with linear lamps of a different technology such as linear LED lamps, shall not be recognized as converting the fluorescent luminaire to a different technology for compliance with Part 6.
- d. An LED lamp, integrated or non-integrated type in accordance with the definition in ANSI/IES RP-16-2010, shall not be classified as a LED lighting system for compliance with Part 6. LED modules having screw-bases including screw based pig-tails, screw-based sockets, or screw-based adaptors shall not be recognized as a LED lighting system for compliance with Part 6.
- e. Luminaires manufactured or rated for use with low-voltage incandescent lamps, into which have been installed LED modules or LED lamps, shall not be recognized as a LED lighting system for compliance with Part 6.

5.9.4 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 §§ 120.8 through §130.5.

5.9.5 Alterations – Prescriptive Approach

A. Scope – Prescriptive Lighting Alterations

When using the Prescriptive Approach, the altered lighting shall meet the applicable requirements of §110.0 through §110.9, §120.0 through §120.6, and §120.8 through §130.5.

Any lighting alteration that increases the installed lighting power in an enclosed space shall meet the requirements of §110.9, §130.0, §130.1, §130.4, §140.3(c), and §140.6.

Lighting Alterations and Luminaire Modifications-in-Place shall not exceed the lighting power allowance in §140.6.

B. Requirements – Prescriptive Lighting Alterations

1. Lighting System Alterations include alterations where an existing lighting system is modified, luminaires are replaced, or luminaires are disconnected from the circuit, removed and reinstalled, whether in the same location or installed elsewhere.
 - a. Luminaire Modifications-in-Place are separately addressed in item C, below.

2. Lighting system alterations do not include:
 - a. Portable luminaires
 - b. Luminaires affixed to moveable partitions
 - c. Lighting excluded in accordance to § 140.6(a)3. (See section 5.4.6 of this chapter)
3. When 10% of the luminaires in an enclosed space are altered, that space shall comply with the requirements in Table 5-10. Affected luminaires include any luminaire that is changed, replaced, removed, relocated; or, connected to, altered or revised wiring.

Following is a summary of the requirements in Table 5-10:

- i. **For alterations that do not change the area of the enclosed space or the space type:**
 - a. When the sum total < 10% of existing luminaires in the enclosed space are altered:
 - The existing lighting power is permitted, and
 - The existing lighting control provisions are permitted
 - b. When the sum total \geq 10% of existing luminaires in the enclosed space are altered, and
 - The resulting installed lighting power density after the alteration is \leq 85% of the allowed lighting power per §140.6 using the Area Category Method:
 - Lighting control requirements are as follows:
 - §130.1(a) Manual Area Controls
 - §130.1(b) Multi-Level Lighting Controls, or have a two level lighting control with at least one control step between 30 and 70% of design lighting power in a manner providing reasonably uniform illuminations
 - §130.1(c) Automatic Shut-Off Controls
 - c. When the sum total \geq 10% of existing luminaires in the enclosed space are altered, and
 - The resulting installed lighting power density after the alteration is $>$ 85% of the allowed lighting power per §140.6 using the Area Category Method
 - Lighting control requirements are as follows:
 - §130.1(a) Manual Area Controls

- §130.1(b) Multi-Level Lighting Controls
 - §130.1(c) Automatic Shut-Off Controls
 - §130.1(d) Daylight Controls. Daylight controls are required only for luminaires that are altered.
- ii. For alterations that change the area of the enclosed space, or change the space type, or increase the lighting power in the enclosed space:**
- a. When any number of existing luminaires in the enclosed space are altered
 - The resulting installed lighting power after the alteration shall not exceed the allowance in §140.6 using the Area Category Method
 - Lighting control requirements are as follows:
 - §130.1(a) Manual Area Controls
 - §130.1(b) Multi-Level Lighting Controls
 - §130.1(c) Automatic Shut-Off Controls
 - §130.1(d) Daylight Controls. Daylight controls are required only for luminaires that are altered.

**TABLE 5- 10: (Table 141.0-E in the Standards)
Requirements for Luminaire Alterations**

Quantity of existing affected luminaires per Enclosed Space ¹	Resulting Lighting Power for Each Enclosed Space	Applicable Mandatory Control Provisions for Each Enclosed Space	Multi-level Lighting Control Requirements for Each Altered Luminaire
Alterations that do not change the area of the enclosed space or the space type			
Sum total < 10% of existing luminaires	Existing lighting power is permitted	Existing provisions are permitted	Existing controls are permitted
Sum total ≥ 10% of existing luminaires	≤ 85% of allowed lighting power per § 140.6 Area Category Method	§130.1(a), (c)	Two level lighting control ² or §130.1(b)
	> 85% of allowed lighting power per § 140.6 Area Category Method	§130.1(a), (c), (d) ³	§130.1(b)
Alterations that change the area of the enclosed space or the space type or increase the lighting power in the enclosed space			
Any number	Comply with § 140.6	§130.0(d) ³ §130.1(a), (c), (d) ³ , (e)	§130.1(b)
1. Affected luminaires include any luminaire that is changed, replaced, removed, relocated; or, connected to, altered or revised wiring, except as permitted by EXCEPTIONS 1 and 2 to § 141.0(b)2lii: 2. Two level lighting control shall have at least one control step between 30 and 70% of design lighting power in a manner providing reasonably uniform illuminations 3. Daylight controls in accordance with § 130.0(d) are required only for luminaires that are altered.			

5.9.6 Luminaire Modifications-in-Place

§141.0(b)2liii

A. Scope – Luminaire Modifications-in-Place

1. A lighting alteration is classified as a Luminaire Modification-in-Place when luminaires are modified by one or more of the following methods:
 - a. Replacing lamps and ballasts with like type or quantity in a manner that preserves the original luminaire listing.
 - b. Changing the number or type of light source in a luminaire including: socket renewal, removal or relocation of sockets or lampholders, and/or related wiring internal to the luminaire including the addition of safety disconnecting devices.

NOTE: As described in the Luminaire Classification and Power Section above (§141.0 (b) 2 I (ii)). A screw-in lighting source replacement is not recognized for reducing the rated wattage of a luminaire nor is it considered an alteration or modification-in-place.

- c. Changing the optical system of a luminaire in part or in whole.

NOTE: A screw-based LED retrofit kit, designed to be installed directly into a recessed downlight having an incandescent

- socket may change the distribution of the luminaire, but this is not considered a luminaire modification in place. As described in Luminaire Classification and Power Section above (§141.0(b) 2 I (ii)) a screw-in light source replacement is not recognized for reducing the rating wattage of a luminaire nor is it considered an alteration or modification in place.
- d. Replacement of whole luminaires one for one in which the only electrical modification involves disconnecting the existing luminaire and reconnecting the replacement luminaire.
2. Lighting alterations not qualifying as a Luminaire Modification-In-Place shall comply with the applicable lighting alteration requirements in §141.0(b)2I(ii). To qualify as a Luminaire Modification-in-Place, the alteration shall NOT be:
 - a. Part of or the result of any general remodeling or renovation of the enclosed space in which they are located.
 - b. The result of, or involve any changes to the panelboard or branch circuit wiring, including line voltage switches, relays, contactors, dimmers and other control devices, providing power to the lighting system.
 - EXCEPTION. Circuit modifications strictly limited to the addition of occupancy or vacancy sensors and class two lighting controls are permitted for Luminaire Modifications-in-Place
 3. For compliance with the Luminaire-Modification-in-Place requirements, a building space is defined as any of the following:
 - a. A complete single story building
 - b. A complete floor of a multi floor building
 - c. The entire space in a building of a single tenant under a single lease
 - d. All of the common, not leasable space in single building
 4. There are two thresholds that, once met, require compliance with the Luminaire-Modifications-in-Place requirements:
 - a. 40 Luminaire-Modifications-in-Place per annum in a building space, as defined above, plus
 - b. When the sum total \geq 10% of existing luminaires in the enclosed space are Luminaire-Modifications-in-Place.

These two thresholds are used to classify the difference between minor repairs and regulated alterations.

Per annum, once the 40 Luminaire-Modifications-in-Place threshold has been met, any room in which $\geq 10\%$ of existing luminaires in the enclosed space are Luminaire-Modifications-in-Place shall meet the requirements in the Standards. Any rooms in which $< 10\%$ of existing luminaires in the enclosed space are Luminaire-Modifications-in-Place are not required to comply. (See Table 5-11).

TABLE 5- 11 Thresholds for Luminaire-Modifications-in-Place requirements

Number of Luminaire-Modifications-in-Place		Is compliance required for that enclosed space?
Per annum per building space	In an enclosed space	
< 40 in number	$< 10\%$	No
< 40 in number	$\geq 10\%$	No
≥ 40 in number	$< 10\%$	No
≥ 40 in number	$\geq 10\%$	Yes

5. Lighting control requirements only apply to enclosed spaces for which there are Luminaire Modifications-in-Place requiring compliance with the Standards
6. Following is a summary of the requirements in Table 5-12:
 - a. When the sum total of < 40 Luminaires per building space are modified in place per annum:
 - The existing lighting power is permitted, and
 - The existing lighting control provisions are permitted
 - b. When the sum total of ≥ 40 Luminaires per building space are modified in place per annum, and
 - The resulting installed lighting power density after the alteration is $\leq 85\%$ of the allowed lighting power per § 140.6 using the Area Category Method:
 - Lighting control requirements are as follows:
 - §130.1(a) Manual Area Controls
 - §130.1(b) Multi-Level Lighting Controls, or have a two level lighting control with at least one control step between 30 and 70% of design lighting power in a manner providing reasonably uniform illuminations

- §130.1(c) Automatic Shut-Off Controls
- c. When the sum total of ≥ 40 Luminaires per building space are modified in place per annum, and
 - The resulting installed lighting power density after the alteration is $> 85\%$ of the allowed lighting power per § 140.6 using the Area Category Method
 - Lighting control requirements are as follows:
 - §130.1(a) Manual Area Controls
 - §130.1(b) Multi-Level Lighting Controls
 - §130.1(c) Automatic Shut-Off Controls
 - §130.1(d) Daylight Controls. Daylight controls are required only for luminaires that are modified-in-place.

**TABLE 5- 12 (Table 141.0-F in the Standards)
Requirements for Luminaire Modifications-in-Place**

For compliance with this Table, building space is defined as any of the following: 1. A complete single story building 2. A complete floor of a multi floor building 3. The entire space in a building of a single tenant under a single lease 4. All of the common, not leasable space in single building			
Quantity of affected luminaires per Building Space per annum	Resulting Lighting Power per Each Enclosed Space Where $\geq 10\%$ of Existing Luminaires are Luminaire Modifications-in-Place	Applicable mandatory control provisions for each enclosed space ¹	Applicable multi-level lighting control requirements for each modified luminaire ²
Sum total < 40 Luminaire Modifications-in-Place	Existing lighting power is permitted	Existing provisions are permitted	Existing controls are permitted
Sum total ≥ 40 Luminaire Modifications-in-Place	$\leq 85\%$ of allowed lighting power per §140.6 Area Category Method	§130.1(a), (c)	Two level lighting control ³ Or §130.1(b)
	$> 85\%$ of allowed lighting power per §140.6 Area Category Method	§130.0(d) ⁴ §130.1(a), (c), (d) ⁴	§130.1(b)
1. Control requirements only apply to enclosed spaces for which there are Luminaire Modifications-in-Place. 2. Multi-level controls are required only for luminaires for which there are Luminaire Modifications-in-Place. 3. Two level lighting control shall have at least one control step between 30% and 70% of design lighting power in a manner providing reasonably uniform illuminations 4. Daylight controls in accordance with § 130.0(d) are required only for luminaires that are modified-in-place.			

5.9.7 Lighting Wiring Alterations

§141.0(b)2iv

A. Lighting Wiring Alterations

1. Lighting Wiring Alterations shall meet the applicable requirements in the following sections of the Standards:
 - a. §110.9 Mandatory requirements for lighting control devices and systems, ballasts, and luminaires.
 - b. §130.1, Indoor lighting controls (Area, Multi-Level, Automatic Shut-OFF, Daylighting, and Demand Responsive).
 - c. §130.4. Acceptance Testing and Installation Certificates.
2. Lighting Wiring Alterations include the following:
 - a. Adding a circuit feeding luminaires.

- b. Modifying or relocating wiring to provide power to new or relocated luminaires.
- c. Replacing wiring between a switch or panelboard and luminaire(s).
- d. Replacing or installing a new panelboard feeding lighting systems.

EXCEPTION Lighting Wiring Alterations allowed for Luminaire Modifications-in-Place in accordance with §141.0(b)2liii

Example 5-8 Threshold for lighting alterations requirements

Question

There are 60 lighting fixtures in an existing office space. We are replacing and relocating five fixtures without increasing the connected lighting load or rewiring any of the fixtures. Which Standards requirements must we comply with?

Answer

Because less than 10% of the existing luminaires in the enclosed space are affected, and the installed lighting power is not being increased, the space may maintain its existing installed lighting power and controls provisions.

Example 5-9 Rewiring of replacement luminaires

Question

If in the example above, the five replaced luminaries are also being rewired, which Standards requirement must be complied with?

Answer

If the modification involves a wiring alteration, the applicable mandatory control requirements in §110.9, §130.1 and §130.4 must be met.

Example 5-10 Standards for lighting alterations

Question

If in the example above, 20 fixtures were being replaced, then which Standards requirements must be complied with?

Answer

Since more than 10 percent of the fixtures are being replaced, the total lighting power in the space must not exceed the lighting power allowance for open offices, of 0.75 W/sf, as described in §140.6. In addition, the space must also meet the mandatory control requirements, depending on the installed lighting power. If the installed power is 85% or less of the lighting power allowance of 0.75W/sf, the space must meet the mandatory requirements in §130.1(a) and §130.1(c), and must have either two level lighting control, or must meet the requirements in §130.1(b). If the installed power is more than 85% of allowed 0.75W/sf, the space must meet the mandatory requirements in §130.1(a), §130.1(b), and §130.1(c), and all altered luminaires must meet the applicable daylighting requirements of §130.1(d).

Example 5-11 Threshold for modifications-in-place**Question**

If in the example above, 20 fixtures were being replaced with fixture kits that only required disconnecting the existing luminaires, and reconnecting the new luminaires, which Standards requirements apply?

Answer

Since this alteration is considered a modification-in-place, and less than 40 fixtures are being modified, the space may maintain its existing installed lighting power and controls provisions.

Example 5-12 Standards for luminaire modifications-in-place**Question**

If in the example above, 50 fixtures were being replaced with fixture kits, which Standards requirements must be complied with?

Answer

Since more than 40 fixtures are being modified, the altered lighting must not exceed the lighting power allowance for open offices, of 0.75 W/sf, as described in §140.6. In addition, the space must also meet the mandatory control requirements, depending on the installed lighting power. If the installed power is 85% or less of the lighting power allowance of 0.75W/sf, the space must meet the mandatory requirements in §130.1(a) and §130.1(c), and must have either two level lighting control, or must meet the requirements in §130.1(b). If the installed power is more than 85% of allowed 0.75W/sf, the space must meet the mandatory requirements in §130.1(a), §130.1(b), and §130.1(c), and all altered luminaires must meet the applicable daylighting requirements of §130.0(d) and §130.1(d).

Example 5-13 Lighting power allowances for additions**Question**

All light fixtures are being replaced in one enclosed room of a commercial tenant space. The entire tenant space currently has a total of 25 light fixtures. The altered room will receive a total of eight new light fixtures. How much lighting power is allowed for the new lighting?

Answer

Since all lighting fixtures within the enclosed area (room) are being replaced, then more than 10 percent of the lighting in the applicable space (the enclosed room) is new. Therefore, the lighting power in this space must not exceed the allowed lighting power for the space as listed in §140.6. The space must also meet the control requirements in Table 5-10, based on the total installed lighting power in the space.

Example 5-14 Skylit zone in renovations**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 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 ft ceiling?

Answer

Yes. §143(c) require skylights in enclosed spaces that are greater than 5,000 ft² directly under a roof with ceiling height over 15 ft. In this example the area with ceiling of greater than 15 ft is 16,000 ft², therefore there are mandatory skylight requirements. (Note: skylight requirements do not apply in climate zones 1 and 16)

Example 5-15 Skylighting requirements for alterations

Question

A pre-existing air-conditioned 30,000 ft² warehouse with 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 §140.9(b)2F does not apply and therefore does not trigger the requirements in §140.3(c) for skylighting.

5.10 Compliance and Enforcement

5.10.1 Indoor Lighting Compliance Documents

The language in this section has not yet been updated to reflect the changes to the 2013 Compliance Documents

At the time a building permit application is submitted to the enforcement agency, the applicant also submits plans and energy compliance documentation. This section describes the recommended forms and procedures for documenting compliance with the lighting requirements of the Standards. It does not describe the details of the requirements. The following discussion is addressed to the designer preparing construction and compliance documents, and to the enforcement agency plan checkers who are examining those documents for compliance with the Standards.

The use of each form is briefly described below, and complete instructions for each form are presented in the following subsections. These forms may be included in the lighting equipment schedules on the plans, provided the information is in a similar format as the suggested form.

- **LTG-1C: Certificate of Compliance:**

This form is required for every job, and all four pages are required to appear on the plans.

- **LTG-2C: Lighting Controls Credit Worksheet:**

This form is only required when calculating control credit watts. See Standards Table 146-C for lighting control credits.

- **LTG-3C: Interior Lighting Power Allowance Worksheet:**

This form is required when calculating the Lighting Power Allowance using the Complete Building, Area Category, or Tailored Method for compliance. For conditioned and unconditioned spaces the allowed watts need to be separately indicated in the appropriate sections on the form.

- **LTG-4C: Tailored Method Worksheet:**

This form should only be required when calculating the Lighting Power Allowance using the Tailored Method.

- **LTG-5C: Line Voltage Track Lighting Worksheet:**

This form is only used when line voltage track lighting is used.

LTG-1C: Certificate of Compliance

The LTG-1C Certificate of Compliance form has four pages. Each page must appear on the plans (usually near the front of the electrical drawings). A copy of these forms should also be submitted to the enforcement agency along with

the rest of the compliance submittal at the time of building permit application. With enforcement agency approval, the applicant may use alternative formats of these forms (rather than the official Energy Commission forms), provided the information is the same and in a similar format.

LTG-1C Page 1 of 4 Certificate of Compliance

Project Description

- PROJECT NAME is the title of the project, as shown on the plans and known to the enforcement agency.
- DATE is the date of preparation of the compliance submittal package. It should be on or after the date of the plans, and on or before the date of the building permit application.
- PROJECT ADDRESS is the address of the project as shown on the plans and as known to the enforcement agency.
- CLIMATE ZONE is the California climate zone in which the project is located. See Joint Appendix JA2 for a listing of climate zones.
- BUILDING CFA is the total conditioned floor area of the building as defined in §101(b). For additions, the total conditioned floor area is the total area of the addition alone. For alterations, the total conditioned floor area refers to only to the altered floor area.
- UNCONDITIONED FLOOR AREA is the total floor area of unconditioned space, as defined in §101(b). For additions, the total unconditioned floor area refers to the addition alone. For alterations, the total unconditioned floor area refers to the altered floor area.

General Information

BUILDING TYPE is specified because there are special requirements for high-rise residential and hotel/motel guest room occupancies. All other occupancies that fall under the Nonresidential Standards are designated “Nonresidential” including schools. It is possible for a building to include more than one building type. See §101(b) for the formal definitions of these occupancies. All appropriate boxes shall be checked as appropriate:

- NONRESIDENTIAL if the project includes nonresidential indoor lighting.
- HIGH-RISE RESIDENTIAL if the project includes common areas of a high-rise residential building. Common areas are any interior areas which are not dwelling units. If this project also includes dwelling units, the residential lighting CF6R-LTG must also be completed and submitted.

- HOTEL/MOTEL if the project includes common areas in a hotel or motel. Common areas of a hotel/motel include any interior areas which are not dwelling units. If the project also includes dwelling units, the residential lighting CF6R-LTG must also be completed and submitted.
- SCHOOLS and RELOCATABLE PUBLIC SCHOOLS
- CONDITIONED SPACES is defined in §101(b) as an enclosed space that is provided with wood or mechanical heating exceeding 10 (BTU/hr ft²) or provided with mechanical cooling exceeding 5 (BTU/hr ft²).
- UNCONDITIONED SPACE is defined in §101(b) as an enclosed space within a building that is not directly or indirectly conditioned.

PHASE OF CONSTRUCTION indicates the status of the building project described in the compliance documents. Refer to section 1.6 for detailed discussion of the various choices.

- NEW CONSTRUCTION should be checked for all new buildings, newly conditioned space or for new construction in existing buildings (tenant improvements, see section 1.7.10).
- ADDITION should be checked for an addition that is not treated as a stand-alone building, but which uses option 2 described in section 1.7.12. Tenant improvements that increase conditioned floor area and volume are additions.
- ALTERATION should be checked for alterations to an existing building lighting system (see section 1.7.12). Tenant improvements are usually alterations.

METHOD OF COMPLIANCE indicates the method of compliance used for the project.

- COMPLETE BUILDING METHOD can be used only on projects involving entire buildings or tenant space with one type of use occupancy or mixed occupancy buildings where one type makes up 90 percent of the entire building or tenant space.
- AREA CATEGORY METHOD, this method may be used when different primary function areas of a building are included in the permit application.
- TAILORED METHOD can be used only on projects with primary function areas that do not use the Area Category Method.

Declaration Statement of Documentation Author

DOCUMENTATION AUTHOR is the person who prepared the energy compliance documentation and who signs the Declaration Statement. The person's telephone number is given to facilitate response to any questions that arise. A Documentation Author may have additional certifications such as an Energy Analyst or a Certified Energy Plans Examiner certification number. Enter number in the EA# or CEPE# box if applicable.

Declaration Statement of Principle Lighting Designer

The Declaration Statement is signed by the person responsible for preparation of the plans for the building and the documentation author. This principal designer is also responsible for the energy compliance documentation, even if the actual work is delegated to someone else (the Documentation Author as described above). It is necessary that the compliance documentation be consistent with the plans. The Business and Professions Code governs who is qualified to prepare plans and therefore to sign this statement. See section 2.2.2 Permit Application for applicable text from the Business and Professions Code.

The person's telephone number is given to facilitate response to any questions that arise.

Lighting Mandatory Measures

The mandatory measures should be incorporated into the construction documents. The designer may use whatever format is most appropriate for specifying the mandatory measures in the plan set. In general, this will take the form of a note block near the front of the set, possibly with cross-references to other locations in the plans where measures are specified. This is offered as a starting point for designers; it should be incorporated into the organization of the plan set and modified to be specific to the building design. When complying with the mandatory measures, the following must be considered if they apply.

A. Mandatory Measures Note Block

The person with overall responsibility must ensure that the Mandatory Measures that apply to the project are listed on the plans. The format of the list is left to the discretion of the Principal Designer.

Sample Notes Block - Lighting Mandatory Measures **Building Lighting Shut-off**

The building lighting shut-off system consists of an automatic time switch, with a zone for each floor.

 Override for Building Lighting Shut-off

The automatic building shut-off system is provided with a manual accessible override switch in sight of the lights. The area of override is not to exceed 5,000 ft².

 Automatic Control Devices Certified

All automatic control devices specified are certified; all alternate equipment shall be certified and installed as directed by the manufacturer.

 Fluorescent Ballast and Luminaires Certified

All fluorescent fixtures subject to certification and specified for the projects are certified.

 Individual Room/Area Controls

Each room and area in this building is equipped with a separate switch or occupancy sensor device for each area with floor-to-ceiling walls.

 Uniform Reduction for Individual Rooms

All rooms and areas greater than 100 ft² and more than 0.8 W/ft² of lighting load shall be controlled with multi-level switching for uniform reduction of lighting within the room.

 Daylit Area Control

All rooms that are greater than 250 ft² and contain windows and skylights, that allow for the effective use of daylight in the area shall have 50 percent of the lighting power in each daylit area controlled by a separate switch; or

The effective use of daylight throughout cannot be accomplished because the windows are continuously shaded by a building on the adjacent lot. Diagram of shading during different times of year is included on plans.

The above notes are only examples of wording. Each mandatory measure that requires a separate note should be listed on the plans.

The Energy Hotline (1-800-772-3300) can verify certification of appliances not found in the above directories.

The Energy Commission's Web Site includes listings of energy efficient appliances for several appliance types. The web site address is <http://www.energy.ca.gov/appliances/database/>

Documenting the mandatory measures on the plans is accomplished through a confirmation statement, notes and actual equipment location as identified on the plans. The plans should clearly indicate the location and type of all

mandatory control devices; such as manual switches, reduced level control, daylight area, controls, building shut-off and overrides, and exterior light controls.

Lighting Worksheet

Check the appropriate boxes to indicate which worksheet(s) are being included with the certificate of compliance.

LTG-1C Page 2 of 4 Indoor Lighting Schedule and Field Inspection Energy Checklist

Page 2 of 4 serves two separate functions:

1. To describe and document the lighting fixtures designed to be installed in the building. The Installed Lighting Power for conditioned and unconditioned spaces is calculated by completing this form.
2. As a Field Inspection Energy Checklist to be utilized by the enforcement agency. The Field Inspector verifies at the end of installation that the LTG-1-INST and the appropriate Certificates of Acceptance have been completed. The Field Inspector also verifies that lighting schedule describes what was installed and checks the appropriate box in column H.

Indoor lighting for conditioned and unconditioned spaces shall be listed on separate pages. Check only one box as appropriate for Conditioned Space, or for Unconditioned Space for each page used.

A:NAME OR ITEM TAG is the name or symbol used on the plans to identify the luminaire.

B:LUMINAIRE DESCRIPTION is a complete narrative description of the luminaire, including the type of luminaire, number and type of lamps in the luminaire, and number and type of ballast(s) in the luminaire. For example:

LUMINAIRE TYPE is the type of luminaire, such as surface mount, recessed troffer, pendant, linear slot, etc.

LAMP TYPE is the type of lamps such as T-8, T-5, high output (HO), etc.

BALLAST TYPE is the type of ballast, such as electronic, dimmable, etc.

C:SPECIAL FEATURES refers to the type of lighting features used to show compliance, such as:

The tailored method, or unconditioned space that must meet prescriptive lighting levels, refer to the Nonresidential ACM Manual section 2.4.2 for more information.

D:WATTS PER LUMINAIRE is the total input wattage of the complete lighting unit. This is rated wattage of the luminaire, not the nominal wattage of the lamp (blub) used in the luminaire.

E: HOW WAS WATTAGE DETERMINED? If CEC DEFAULT is checked, this indicates the wattage is a standard value taken from the data in Reference Nonresidential Appendix NA8. If this column is not checked, this indicates the

nonstandard values must be substantiated with manufacturer's data sheets and determined according to §130(d or e).

F:NUMBER OF LUMINAIRES is the number of identical luminaires in the space.

G:INSTALLED WATTS is total installed watts for identical luminaire installed in the space, which is the product of WATTS PER LUMINAIRE and NUMBER OF LUMINAIRES (Columns C X F).

After the page has been completed, all of the installed watts in Column G shall be added up and shown in the Page Total cell.

H:FIELD ISNPSECTOR is to verify if the items listed in the lighting schedule are equal to what was installed.

BUILDING TOTAL NUMBER OF PAGES indicates when multiple lighting schedules are present.

BUILDING TOTAL is the sum of all page totals. The sum is also to be entered into Part 4 of the LTG-1C.

If more than one page of LTG-1C (Page 2 of 4) is needed, list the Building total number of pages that were used in the appropriate cell at the bottom of the page. Add up all of the Column G page totals, and list as the Building Total (Sum of all pages).

LTG-1C Page 3 of 4 – Mandatory Lighting Controls Schedule and Field Inspection Energy Checklist

LTG-1C, Part 3 of 4 is required to show compliance with the mandatory lighting control requirements, and serves two separate functions:

1. To describe and document the mandatory lighting controls.
2. As a Field Inspection Energy Checklist to be utilized by the enforcement agency. The Field Inspector verifies at the end of installation that the LTG-1-INST and the appropriate Certificates of Acceptance have been completed. The Field Inspector also verifies that lighting control schedule describes what was installed and checks the appropriate box
 - CONTROL TYPE/DESCRIPTION lists the type of certified control device used to meet the control requirement. Such controls include occupant, daylight, dimming sensors etc. The type should use the same name as shown on the plans.
 - NUMBER OF UNITS is the number of controls of the same type.
 - LOCATION IN BUILDING indicates the room or space the control is to be used and should be named the same as shown on the plans.

The Field Inspector also verifies that lighting schedule describes what was installed and checks the appropriate box in the column.

The space entitled SPECIAL FEATURES INSPECTION CHECKLIST is provided for listing specific features of the design that required special written justification, documentation and verification.

LTG-1C Page 4 of 4 – Indoor Lighting Power for Conditioned and Unconditioned Spaces

The indoor lighting power calculations are to be separate between conditioned and unconditioned spaces. Trade-offs between the two spaces is not allowed.

- INSTALLED LIGHTING is total amount of watts calculated on Page 2 of the LTG-1C for either conditioned or unconditioned space as checked on Page 2 of LTG-1C
- LIGHTING CONTROL CREDIT is the amount watts calculated on the LTG-2C for either conditioned or unconditioned space as checked on LTG-2C
- ADJUSTED INSTALLED LIGHTING POWER is the difference between the INSTALLED LIGHTING and the LIGHTING CONTROL CREDIT. The result is the amount of lighting power compared to the ALLOWED LIGHTING POWER for compliance.
- ALLOWED LIGHTING POWER is calculated on the LTG-3C using the Complete Building, Area Category or Tailed Methods of compliance, for either conditioned or unconditioned space.

The designer must indicate in the space entitled REQUIRED ACCEPTANCE TEST, LTG-2A, as to which of the installed equipment requires testing. A short description should be given of the equipment type, number of controls and the location of the building in which the system is installed.

LTG-2C: Lighting Controls Credit Worksheet

LTG-2C is used to report the lighting control credits for conditioned and unconditioned spaces. This worksheet is required whenever lighting control credits are claimed on LTG-1C (Page 4 of 4).

When certain types of automatic lighting controls are listed in Table 146-C (Power Adjustment Factors) in the Standards, a credit is permitted. This table also lists some restrictions that must be met in order to take credit for the controls. A separate worksheet must be completed for conditioned and unconditioned spaces. Check only one box as appropriate per page, for Conditioned Space, or for Unconditioned Space.

At least 50 percent of the light output of the luminaire must be within the applicable space for which the lighting control credit is claimed.

LTG-2C Page 1 of 2 – Lighting Control Credits for Non-Daylight Controls

LTG-2C (Page 1 of 2) is used to report control credits allowed in Table 146-C which are not daylighting control credits. (Daylighting control credits are separately reported on page 2 of 2). The bottom of (Page 1 of 2) is also used to add together the non-daylight control credits plus the daylight control credits to determine the total lighting control credit available.

A:ROOM # – List the room where the control device is controlling luminaires.

B:LIGHTING CONTROL DESCRIPTION – List a description of the device that is consistent with the controls listed in Table 146-C.

C:PLAN REFERENCE – Indicate where on the plan set the controls are shown.

D:ROOM AREA – Indicate the area of the room in which the controls are located.

E:WATTS OF CONTROL LIGHTING – The watts of only the lighting in each room controlled by that specific control device shall be listed here. Do not include watts in a room that are not controlled by the specific control for which the adjustment factor is claimed.

F: POWER ADJUSTMENT FACTOR – Indicate the power adjustment factor for that specific control device from Table 146-C in the Standards.

G:CONTROL CREDIT WATTS – The product of COLUMN E (Watts of Control Lighting) and COLUMN F (Power Adjustment Factor).

If there are Lighting Control Credit Worksheets for both conditioned and unconditioned spaces, the total lighting control credits shall be separately determined for conditioned and unconditioned spaces

The Page Total for column G is entered near the bottom of the Page 1 of 2. If more than one page of LTG-2C (Page 1 of 2) is needed, list the total number of pages used in the appropriate cell near the bottom of the page.

If more than one page of LTG-2C (Page 1 of 2) is used for conditioned spaces, add all of the Page Totals together and enter in the appropriate cell on the bottom of the page for which Conditioned is checked. Likewise, if more than one page of LTG-2C (Page 1 of 2) is used for unconditioned spaces, add all of the Page Totals together and enter in the appropriate cell on the bottom of the page for which Unconditioned is checked.

If there are Power Adjustment Factors for daylight controls determined on Page 2, enter the total of all daylight controls credits from Page 2 into the appropriate cell on the bottom of Page 1.

The total control credit watts (entered on LTG-1C, Part 4 of 4) are the sum of the control credit watts taken from the bottom cell in COLUMN G. This credit is subtracted from the total installed watts to determine the actual lighting power (adjusted).

LTG-2C Page 2 of 2 – Lighting Control Credits for Daylight Controls

LTG-2C (Page 2 of 2) is used to report daylight control credits allowed in Table 146-C in the Standards. At least 50 percent of the light output of the luminaire must be within the applicable daylight area listed in Table 146-C.

A:ROOM # – List the room where the control device is controlling luminaires.

B: TYPE DAYLIGHT CONTROLLED – Check one of the three boxes to indicate the daylighting area controlled as follows:

- Check Skylit only if the qualifying control device is used to control only lighting in the Skylit area.

- Check Primary Sidelit if the qualifying control device is used to control only lighting in the Primary Sidelit area
- Check Secondary Sidelit if the qualifying control device is used to control only lighting in the Secondary Sidelit area, or is used to control the lighting in both the Primary and Secondary Sidelit areas together.

C:PLAN REFERENCE – Indicate where on the plan set the controls are shown.

D: DAYLIGHT AREA – Indicate square feet of daylight area for the type of daylight controlled that was checked in Column B, Do not double count overlapping daylight areas. Indicate the daylight area as follows:

- Primary Sidelit Area according to Section 131(c)1B
- Secondary Sidelit Area according to Section 131(c)1C
- Skylight Area according to Section 131(c)1D

E: VT (Visible Light Transmittance) – Enter VT of windows or skylights determined in accordance with Section 146(a)2E.

F: FOR SKYLIGHTS – When Skylit is checked in Column B, indicate Well Efficiency, Well Cavity Ratio, and Skylit Area, determined in accordance with Section 146(a)2E(iii). These are the assumptions that were used when determining the effective aperture for Column G.

G:EFFECT APERTURE – Indicate Primary Sidelit, Secondary Sidelit, or Skylit Effective Aperture according to which box has been checked in Column B, and determined according to Section 146(a)2E.

H: GENERAL LIGHTING POWER DENSITY (W/ft^2) – Indicate only the W/ft^2 used for general lighting in the room or area where the PAF for daylight controls is claimed. The W/ft^2 is required as one of the factors in Table 146-C for determining the PAF allowed.

I:WATTS OF CONTROL LIGHTING – The watts of only the lighting in each room controlled by that specific daylight control device shall be listed here. Do not include watts in a room that are not controlled by the specific control for which the adjustment factor is claimed.

J: POWER ADJUSTMENT FACTOR – Indicate the power adjustment factor for that specific daylight control device from Table 146-C in the Standards.

K:CONTROL CREDIT WATTS – The product of COLUMN I (Watts of Control Lighting) and COLUMN J (Power Adjustment Factor).

If there are daylighting Control Credit Worksheets for both conditioned and unconditioned spaces, the total daylighting control credits shall be separately determined for conditioned and unconditioned spaces

The Page Total for column K is entered near the bottom of the Page 2 of 2. If more than one page of LTG-2C (Page 2 of 2) is needed, list the total number of pages used in the appropriate cell near the bottom of the page.

If more than one page of LTG-2C (Page 2 of 2) is used for conditioned spaces, add all of the Page Totals together and enter in the appropriate cell

on the bottom of the page for which Conditioned is checked. Likewise, if more than one page of LTG-2C (Page 2 of 2) is used for unconditioned spaces, add all of the Page Totals together and enter in the appropriate cell on the bottom of the page for which Unconditioned is checked.

Enter the total of all daylight controls credits from Page 2 into the appropriate cell on the bottom of Page 1.

LTG-3C: Indoor Lighting Power Allowance

Allowed Lighting Power

The lighting power allowance is determined by calculating the maximum total watts of lighting that may be installed. There are three different prescriptive methods, plus the performance method, that may be used. These methods may not be mixed in the same building permit application, except as specifically allowed according to Section 146(b).

There are separate sections in LTG-3C for each of the different prescriptive compliance methods.

Indoor Lighting Power Allowance for conditioned and unconditioned spaces shall be listed on separate pages. Check only one box as appropriate for Conditioned Space, or for Unconditioned Space for each page used.

Complete Building Method

This method may only be used when plans and specifications for the entire building or tenant space are included in the permit application. Also, the building or tenant space must involve only one type of use occupancy or mixed occupancy where one type of occupancy makes up 90 percent of the space. Lighting power determined according to the Complete Building Method may be traded only within a single building.

A: BUILDING CATEGORY is the occupancy type description listed in §146, Table 146-E.

B: WATTS PER SF is the listed alongside the occupancy description in Standards Table 146-E.

C: COMPLETE BUILDING AREA is the area of the entire building or tenant space.

D: ALLOWED WATTS is the product of the COMPLETE BUILDING AREA and WATTS PER SF.

The sum of the lighting power allowance is the lighting power allowance for the building.

Area Category Method

This method may be used when different primary function areas of a building are included in the permit application.

A:AREA CATEGORY is taken from Table 146-C in the Standards for the primary function of the area. If the building has a mixture of areas, each function area must be listed separately.

B:WATTS PER SF for that building type is taken from Standards Table 146-C and entered here.

C:AREA (SF) is the floor area of the primary function area, which is calculated by multiplying the width times the depth, as measured from the center of the interior bounding partitions. If the function area is bounded by exterior walls on one or more sides, the area is calculated by multiplying the width times the depth, as measured from the inside surface of the exterior walls to the center of the interior bounding partitions. If there are no partitions separating the boundary of the function areas on one or more sides, the boundary of the area is determined by a line separating the function areas where no bounding partitions exist.

D:ALLOWED WATTS is the product of the WATTS PER SF times the AREA (SF). This becomes the lighting power allowance for the area.

The sum of the lighting power allowance for each primary function area is the lighting power allowance for the building.

Tailored Method

This method may be used only on projects with primary function areas that do not use the Area Category Method, and cannot be used on buildings using the Complete Building Method. A separate set of LTG-4C forms shall be filled out for Conditioned and Unconditioned Spaces.

When the Tailored Method is used, the LTG-4C form, or a similar form, must be included in the compliance submittal. Enter into the Tailored Method section at the bottom of LTG-3C the number determined in Row 3 (Page 1 of 4) of LTG-4C.

LTG-4C: Tailored Method Worksheets

The Tailored Method is the most detailed method of calculation for the Lighting Power Allowance. The Lighting Power Allowance is determined based on the individual needs of each task. This method is appropriate for buildings that have unusual lighting needs and in some cases, may increase the lighting power allowance to meet those needs. For a complete description of this method, refer to Section 0.

If there are both conditioned and unconditioned spaces in a building and the Tailored Method is used to determine the allowed lighting power for both types of spaces, separate tailored method worksheets (LTG-4C) must be filled out, one for conditioned spaces and one for unconditioned spaces. Each form must clearly indicate if it is used for conditioned or unconditioned spaces. Note that unconditioned spaces are all those areas that are not directly or indirectly conditioned. The conditioned and unconditioned allowances must be kept separated because when the performance method is used to show

compliance for the entire building, the tailored LPD lighting for only the conditioned space must be entered for both the standards and proposed buildings. Inclusion of the unconditioned LPD would result in erroneous HVAC load calculations.

LTG-4C: Page 1 of 4

This form shall be submitted with all tailored method applications. It summarizes the results of the different parts of LTG-4C, and includes the lighting power allowance calculations for illuminance categories A through G (Standards Table 146-I).

Tailored Method Summary

1. LINE 1 is the BUILDING TOTAL ALLOWED WATTS for general lighting power for illuminance categories A through G. This value is the summation of all the individual allowed watts calculation in column G.

LINE 2 is the BUILDING TOTAL ALLOWED WATTS for display, floor, very valuable merchandise and ornamental/special effects lighting. This value is obtained from the total watts entries on LTG-4C, Page 2, and Page 3. Each allotment is separately calculated and entered into the appropriate box on this form.

LINE 3 is the sum of lines 1, and 2. The TOTAL ALLOWED WATTS is the lighting power allowance using the Tailored Method. This number shall be inserted into the appropriate conditioned or unconditioned section at the top of LTG-1C (Page 4 of 4).

Tailored LPD – Illuminance

To complete the Tailored Allowed General Lighting Power in the lower portion of Page 1 of this form, complete the following steps.

- A. ROOM NUMBER is the space designation and should correspond with the plans.
- B. PRIMARY FUNCTION TYPE is one of the Primary Functions identified in Column 1 of Table 146-G of the Standards.
- C. ILLUMINANCE CATEGORY is the illuminance category for the room or space. This is determined according to the letter identified in Column 2 of Table 146-G, or if IESNA HB is listed in Column 2, using the IES Handbook, Ninth Edition, 2000.
- D. ROOM CAVITY RATIO is the room cavity ratio (RCR) of each room or space. A RCR of less than 3.5 may be assumed for any room and the “N” box shall be checked. The LTG-4C, Page 4 of 4, shall be used to calculate an RCR greater than or equal to 3.5 and the ‘Y’ box shall be checked.
- E. FLOOR AREA is the actual floor area of the room or space from the plans. If the floor area extends all the way to a permanent full-height

partition, the area is determined by measuring from the inside of the partitions that bound the task area.

- F. ALLOWED LPD Is the Light Power Density from Table 146-F in the Standards using the illuminance category (COLUMN B) and room cavity ratio (COLUMN C) for each room.
- G. ALLOWED WATTS is the product of the Floor Area (Column D) times Light Power Density (Column E). The sum of all rows in Column G shall be entered as the Page Total at the bottom of the page. If more than one page of LTG-4C is needed, add all of the page totals together to determine Building Total. The Building total for all rooms or spaces shall be entered in line 1 at the top of LTG-4C, Page 1 of 4.

LTG-4C: Page 2 of 4

Display Lighting: Walls

On the top half of LTG-4C (Page 2 of 4) is a table with calculations used to determine how many watts are allowed for wall display lighting. The total allowed watts is the smaller of the allotted watts or the design watts.

Wall display lighting must be mounted within 10 feet of the wall it is illuminating. Note: Display lighting is provided to create contrast to the general lighting system. Ceiling mounted fluorescent fixtures do not qualify as wall display lighting. However, fluorescent fixtures which are integrated into wall shelves do qualify as display lighting.

Check the box at the top of the table to document that qualifying wall display lighting systems are mounted within 10 feet to the wall that the display lighting is illuminating.

A: LUMINAIRE DESCRIPTION is a description of the type of luminaire, such as track, ceiling mounted PAR, or built in cabinet. .

B: MOUNTING HEIGHT is the fixture mounting height for wall display lighting, measured from the floor to the bottom of the fixture. Section 0 contains a discussion on how to determine the mounting height.

C: MOUNTING HEIGHT ADJUSTMENT FACTORS are the mounting height adjustment factors for display luminaires. Select the proper factor from Standards Table 146-H and show in this column. Note: Mounting heights ≤ 11'6" must use 1.0 in this column.

D: WALL DISPLAY LENGTH is the wall length of the display from the plans. This length must be totaled at the bottom of the column. Note: How to determine the length of display walls is described in Section 146(c)3B(i).

E: WALL DISPLAY POWER is the lighting power allowance from Standards Table 146-G for wall display luminaires.

F: ALLOTTED WATTS is the product of the mounting height adjustment factor (COLUMN C) times the lighted display wall length (COLUMN D) times lighting power allowance density (COLUMN E).

G:LUMINAIRE CODE is the luminaire name (consistent with LTG-1C and LTG-2C) that is illuminating the display. If more than one luminaire type is used to illuminate the display, each type must be listed separately. Multiple lines on this form may be used for this list.

H:LUMINAIRE QUANTITY is the number of identical luminaires used to illuminate the wall display. If track lighting is used the actual length of track is entered in this column.

I:WATTS PER LUMINAIRE is the total wattage of each luminaire type (including ballasts for fluorescent or high intensity discharge fixtures). See §130(d or e) for how to determine the watts of these types of luminaires. Note: If line-voltage track lighting is used here, then LTG 5-C must also be filled out and submitted. If individual incandescent fixtures are used, it is the maximum relamping rated wattage, not the wattage of the bulb that is used.

J:DESIGN WATTS is the product of the quantity of luminaires (COLUMN H) times the watts per luminaire (COLUMN I). If more than one luminaire type is used to illuminate the task or activity, the subtotal for all the luminaires illuminating the task should be indicated in this column on a separate line of the form.

K:ALLOWED WATTS is the lesser of either the allotted watts (COLUMN F) or the design watts (COLUMN J).

The sum of the allowed watts in COLUMN K is entered on Line 2, Page 1 of the LTG-4C. Add all of the rows together and enter as Total Watts. Transfer this number to the Wall Display cell in row 2 at the top of LTG-4C (Page 1 of 4).

Display Lighting - Floors

On the bottom half of LTG-4C (Page 2 of 4) is a table with calculations to determine how many watts are allowed for floor display lighting. The total allowed watts is the smaller of the allotted watts or the design watts.

Floor display lighting must be mounted more than 2 feet from a wall. Note: Display lighting is provided to create contrast to the general lighting system. There are no fluorescent fixtures which qualify as floor display lighting. Complete the bottom portion of Page 2 of this LTG-4C, using the following steps.

A: LUMINAIRE DESCRIPTION is a description of the type of luminaire, such as track or ceiling mounted PAR.

B:MOUNTING HEIGHT is the fixture mounting height, measured from the floor to the bottom of the fixture. Section 0 contains a discussion on how to determine the mounting height.

C:MOUNTING HEIGHT ADJUSTMENT FACTOR is the mounting height factor taken from Table 146-H. Note: Mounting heights $\leq 11'6"$ must use 1.0 in this column. Select the proper factor from Standards Table 146-H and show in this column.

D:FLOOR AREA is the area of the primary function of that space. Note: Floor area using the Complete Building or Area Category Methods cannot use the Tailored Method. This area must be totaled at the bottom of the column.

E:FLOOR DISPLAY POWER is the lighting power allowance from Standards Table 146-G for floor display luminaires.

F:ALLOTTED WATTS is the product of the mounting height adjustment factor (COLUMN C) times the floor area (COLUMN D) times floor display power (COLUMN E).

G:LUMINAIRE CODE is the luminaire name (consistent with LTG-1C and LTG-2C) that is illuminating the display. If more than one luminaire type is used to illuminate the display, each type must be listed separately. Multiple lines on this form may be used for this list.

H:LUMINAIRE QUANTITLY is the number of identical luminaires used to illuminate the display. If track lighting is used, and the plans do not indicate the number of fixtures to be used on the track, the actual length of track is entered in this column.

I:WATTS PER LUMINAIRE is the watts per luminaire as determined according to Section 130(c or d) as applicable. Note: If line-voltage track lighting is used here, then LTG 5-C must also be filled out. If individual incandescent fixtures are used, it is the maximum relamping rated wattage, not the wattage of the bulb that is used.

J:DESIGN WATTS is the product of the quantity of luminaires (COLUMN H) times the watts per luminaire (COLUMN I). If more than one luminaire type is used to illuminate the task or activity, the subtotal for all the luminaires illuminating the task should be indicated in this column on a separate line of the form.

K:ALLOWED WATTS is the lesser of either the allotted watts (COLUMN F) or the design watts (COLUMN J).

Add all of the rows together and enter as Total Watts. Transfer this number to the Floor Display cell in row 2 at the top of LTG-4C (Page 1 of 4).LTG-4C: Page 3 of 4

On the top half of LTG-4C (Page 3 of 4) are calculations to determine how many watts are allowed for ornamental and special effects lighting. The total allowed watts is the smaller of the allotted watts or the design watts.

Ornamental and Special Effects Lighting includes chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes (LEDs), theatrical projectors, moving lights and light color panels (used decoratively, not as display lighting). Qualifying ornamental/special effects lighting is described in Section 146(c)3B(iii) of the Standards. If allowed in Standards Table 146-G column 5, use this form to compute the power allowance. If there is a zero for a Primary Function are listed in column 5 of Table 146-G, then no Ornamental/Special Effects lighting is allowed.

A:LIGHTING DESCRIPTION is a description of the type of ornamental/special effects lighting consistent with Section 146(c)3B(iii) of the Standards.

B:FLOOR AREA is the area of the primary function for the space containing the ornamental or special effects lighting.

C:ORNAMENTAL/SPECIAL EFFECT LPD is the lighting power allowance density from COLUMN 5 of Standards Table 146-G.

D:ALLOTTED WATTS is the product of the area (COLUMN B) and the lighting power density (COLUMN C).

E:LUMINAIRE CODE the luminaire name (consistent with LTG-1C and LTG-2C). Multiple lines on this form may be used to list multiple luminaires.

F:QUANTITY is the number of identical luminaires used for ornamental or special effects lighting..

G:WATTS PER LUMINAIRE is the watts per luminaire as determined according to Section 130(c or d) as applicable.

H:DESIGN WATTS is the product of the quantity of luminaires (COLUMN F) times the watts per luminaire (COLUMN G). If more than one luminaire type is used to illuminate the task or activity, the subtotal for all the luminaires illuminating the task should be indicated in this column on a separate line of the form.

I:COLUMN I - is the lesser of either the allotted watts (COLUMN D) or the design watts (COLUMN H).

Add all of the rows together and enter as Total Watts. Transfer this number to the Ornamental/Special Effects Display cell in row 2 at the top of LTG-4C (Page 1 of 4).Very Valuable Merchandise Display Cases

On the bottom half of LTG-4C (Page 3 of 4), this table is a series of calculations to determine how many watts are allowed for very valuable merchandise or other very valuable display lighting. The total allowed watts is the smaller of the allotted function area watts, allotted display case area watts, or the design watts.

Very valuable merchandise display cases that contain jewelry and other valuable merchandise are allotted an increase in the Lighting Power Allowance Density, as described in §146(c)3Biv. These displays may include jewelry, coins, fine china or crystal, precious stones, silver or other precious metal, small art objects and artifacts, or other valuable collections that require inspection of fine detail from outside a locked case.

A:LUMINAIRE NAME is the name of the luminaire or location as specified on the plans.

B:FLOOR AREA is the area of the primary function area for that space.

C: VALUABLE DISPLAY POWER is 1.0 W/ft² according to §146(c)3Biva. This number has already been entered into Column C.

D:FUNCTION AREA WATTS is the product of the floor area (COLUMN B) and the lighting power density (COLUMN C).

E:DISPLAY CASE AREA is the area of the display case.

F:16 W/ft² is from §146(c)3Bivb.

G:DISPLAY CASE AREA WATTS is the product of the area (COLUMN E) and the lighting power density (COLUMN F = 16 W/ft²).

H:LUMINAIRE CODE is the luminaire code (consistent with LTG-1C and LTG-2C). Multiple lines on this form may be used to list multiple luminaires.

I:QUANTITY is the quantity of identical luminaires used for very valuable display lighting.

J:WATTS PER LUMINAIRE is the total wattage of each luminaire type determined according to §130(cord) as appropriate.

K:DESIGN WATTS is the product of the quantity of luminaires (COLUMN I) times the watts per luminaire (COLUMN J). If more than one luminaire type is used to illuminate the task or activity, the subtotal for all the luminaires illuminating the task should be indicated in this column on a separate line of the form.

L:ALLOWED WATTS is the lesser of the allotted watts for the space area (COLUMN D), the allotted watts for the very valuable display area (Column G), or the design watts (COLUMN K).

Add all of the rows together and enter as Total Watts. Transfer this number to the Very Valuable Merchandise cell in row 2 at the top of LTG-4C (Page 1 of 4). As with all applications in illuminance category G, the allowed lighting watts for feature displays may not exceed the actual installed wattage. This prevents unused display lighting allotments from being used in other areas of the store.

LTG-4C: Page 4 of 4

Room Cavity Ratio Worksheet (>3.5)

Form LTG-4C (Page 4 of 4) is a form that must be filled out and submitted whenever the Tailored Method is used for compliance with the Standards. A separate form must be completed for conditioned and unconditioned spaces.

Rooms in a building, which are relatively large generally, have a high RCR. If the RCR is greater than or equal to 3.5, a higher LPD is allowed. If the RCR is less than 3.5, it does not need to be included on this form.

The form has two sections: **Rectangular Spaces** is for rooms with four 90° walls, and **Non-rectangular Spaces** is for all other room types (including oblique four walled and circular rooms).

Rectangular Spaces

A:ROOM NUMBER, this column should list each room's number, and should correspond with the plans.

B:TASK/ACTIVITY DESCRIPTION for the room should be listed in this column. If the room has multiple tasks or activities, use the dominant activity for the room in this column.

C:ROOM LENGTH is the length (L) of the room, measured in linear feet, from the interior surfaces of opposing walls. The length is typically the longest distance between two parallel walls in the room.

D:ROOM WIDTH is the width (W) of the room, measured in linear feet, from the interior surfaces of opposing walls. The width is typically the smallest distance between two parallel walls in the room.

E:ROOM CAVITY HEIGHT is the vertical distance, measured in linear feet, from the work plane to the center line of the lighting fixture. This measurement is called the room cavity height (H).

F:ROOM CAVITY RATIO (RCR) is 5 multiplied by the product of the room cavity height H (from COLUMN E) and the sum of the room length and width (L from COLUMN C plus W from COLUMN D), all divided by the room area L (from COLUMN C) times room width (W from COLUMN D). This quantity is the RCR and shall be entered in COLUMN D of Page 1 of LTG-4C.

Non-rectangular Spaces

A:ROOM NUMBER, this column should list each room's number, and should correspond with the plans.

B:TASK/ACTIVITY DESCRIPTION for the room should be listed in this column. If the room has multiple tasks or activities, use the dominant activity for the room in this column.

C:ROOM AREA is the interior area (A) of the room in square feet. This should be determined by whatever means appropriate for the shape of the room.

D:ROOM PERIMETER is the room perimeter (P) measured in feet along the interior surfaces of the walls that define the boundaries of the room. For rooms with angled walls, this is the sum of the interior lengths of each wall in the room. For circular rooms, this is the interior radius of the room multiplied by 2 and pi (3.413).

E:ROOM CAVITY HEIGHT is the vertical distance, measured in linear feet, from the work plane to the center line of the lighting fixture. This measurement is called the room cavity height (H).

F:ROOM CAVITY RATIO (RCR) is 2.5 multiplied by the product of the room cavity height H (from COLUMN E) and room perimeter P (from COLUMN D), all divided by the room area A (from COLUMN C). This quantity is the RCR and shall be entered in COLUMN D of Page 1 of LTG-4C.

LTG-5C: Line Voltage Track Lighting Worksheet

LTG-5C shall be used to calculate and document all line voltage track and busway lighting. (Line voltage track typically operates around 120 volts or greater). Completing this form and entering the results on LTG-2C calculate the installed lighting power for line voltage track lighting.

To determine luminaire wattage incorporated into the installed lighting power for line voltage track lighting, use one of the two Methods described in 5.4.3 of the Nonresidential Manual.

There are four different methods available for determining track and busway lighting input wattage as follows:

Method 1 – Volt-Ampere (VA) Rating of the Branch Circuit(s) Feeding the Tracks or Busway, or the Wattage of Integral Current Limiters

Note: The Standards do not allow the VA rating to be devalued by 20%, even though the California Electric Code does require circuits to be loaded to no

more than 80% of their capacity. The energy Standards are not the same as the Electric Code

If using this method to determine track or busway lighting power, check the box to the left of “Method 1.” Also check one of the two following boxes to indicate if the method is being used to determine wattage for track or busway rated for more than 20 amperes, or for 20 amperes or less.

A:BRANCH CIRCUIT NAME OR ID is the name or number that identifies the branch circuit feeding the track. This column must be filled for all branch circuits feeding track lighting systems.

B:VOLT-AMPERE RATING list the volt-ampere rating of the branch circuit identified in column A. Fill out this column only when you are using the VA of the branch circuit to determine the wattage of the track(s). If integral current limiters are used to determine the wattage of the tracks, do not use this method. The total of column B shall be entered in the appropriate space provided on Page 2 of the LTG-5C.

Method 2 – Use the Higher of: 45 watts per linear foot of track or the maximum relamping rated wattage of all luminaires.

If using this method to determine track or busway lighting power, check the box to the left of “Method 2.”

A:TRACK NUMBER OF NAME is the name or number that identifies the track lighting and should correspond to the plans.

B:LINEAR FEET OF TRACK is the length of track measured in linear feet.

C:WATTS PER LINEAR FEET is 45 W/lf. This number is required for using Method 2.

D:WATTS CALCULATED by multiplying the linear feet (column B) by the assumed watts per linear feet (column C).

E:TOTAL RATED WATTAGE is the rated wattage of each luminaire (track head) that will be installed on the line voltage track identified in column A according to §130(c or d) . Luminaire wattage for incandescent track heads is based upon the rating of the track head, not the wattage of the bulb that is screwed into the track head. The Wattage of incandescent track heads shall be the maximum relamping rated wattage as listed on a permanent pre-printed factory-installed label according to §130(c)1. Luminaire wattage for fluorescent and high intensity discharge (HID) track heads shall be the operating input wattage of the rated lamp/ballast combination according to §130(c)2. Luminaire wattage for low-voltage track heads (when mounted on line-voltage track) shall be the maximum rated wattage of the transformer on each track head according to §130(c)5. Add up the wattage for every luminaire that will be installed on the identified track and enter the total amount as the rated wattage.

F:WATTS INSTALLED is the larger of column D or column E. This is the installed lighting power for the track listed in column A. Add up all of the numbers in column F and list the total at the bottom. Enter this number in the space provided in Page 2 of the LTG-5C.

Method 3 – Use the Higher of: 12.5 watts per linear foot of track or the VA rating of the integral current limiter.

If using this method to determine track or busway lighting power, check the box to the left of “Method 3.” Also, check the box to indicate that the integral current limiter has been certified to the Energy Commission.

This method may be used only for Track Lighting Integral Current Limiters which have been certified to the Energy Commission, and listed on the Energy Commission database of certified devices. Devices which have not been certified to the Energy Commission and other assembly of controls shall not qualify as Track Lighting Integral Current Limiters.

A: TRACK NUMBER OF NAME is the name or number that identifies the track lighting and should correspond to the plans.

B: LINEAR FEET OF TRACK is the length of track measured in linear feet.

C: WATTS PER LINEAR FEET is 12.5 W/lf. This number is required for using Method 3.

D: WATTS CALCULATED by multiplying the linear feet (column B) by the assumed watts per linear feet (column C).

E: VA RATING is the volt-ampere rating of the integral current limiter controlling the track or busway as specified in §130(d)3Biii

F: WATTS INSTALLED is the larger of column D or column E. This is the installed lighting power for the track listed in column A. Add up all of the numbers in column F and list the total at the bottom. Enter this number in the space provided at the bottom of the page.

Method 4 – Dedicated Track Lighting Over Current Protection Panel.

If using this method to determine track or busway lighting power, check the box to the left of “Method 3.” Also, all five of the following boxes shall be checked to document that the supplemental overcurrent protection panel complies with all of the required provisions in the Standards.

A: NAME OR ID is the description of the track lighting that corresponds to the plans.

B: VOLTAGE OF THE BRANCH is the total voltage of the branch described in column A.

C: LIST OF AMPERAGE RATING is the complete list of each device installed the panel for the branch described in column A.

D: SUM OF THE AMPERE RATING is the sum of the listed values from column C.

E: WATTS INSTALLED is the product of the voltage of the branch (column B) and the sum of the ampere ratings (column D). The total from column E should be entered on the appropriate space at the bottom of the form.

At the bottom of Page 2 of the LTG-5C, the total track/busway wattage is totaled for each of the compliance methods utilized, and this number shall be entered on the LTG-2C.

5.10.2 Installation Certificate

A new two-page form, LTG-INST, the Installation Certificate has been included in the Nonresidential Compliance Manual. This form includes general information about the project, a declaration statement, the responsible person's name and signature, and a table to identify all applicable construction documents for the scope of responsibility for the Installation Certificate.

§10-103(a)3 requires, for all buildings, the person with overall responsibility for construction or the person(s) responsible for the installation of features, materials, components or manufactured devices regulated by the Standards or the Appliance Efficiency Regulations shall submit Installation Certificate(s).

For all buildings, a copy of the Installation Certificate(s) shall be posted, or made available with the building permit(s) issued for the building, and shall be made available to the enforcement agency for all applicable inspections.

5.10.3 Certificate of Acceptance

Acceptance tests, LTG-2A, are used to verify that lighting controls were installed and calibrated correctly. These tests require that a responsible party certify that controls are installed and calibrated properly. This responsible party is typically the contractor who installed the lighting controls. To verify that they are calibrated properly, the responsible party must conduct a test and make modifications to the control until it passes the test. The test results must be recorded on acceptance test forms and are part of the building documentation. These forms must be filled out before the enforcement agency grants a certificate of occupancy.

The Standards have acceptance test requirements for:

- Manual daylighting controls
- Automatic daylighting controls.
- Occupancy sensors.
- Automatic time-switch controls.

A detailed description of each acceptance test can be found in Chapter 10 of this manual, Acceptance Requirements and in the Reference Nonresidential Joint Appendix NA7.6.

