

# Indoor Controls

## Draft Code Language

Last Updated: March 21, 2017

## 1. INTRODUCTION

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The California Statewide Utility Codes and Standards Team actively supports the California Energy Commission in developing revisions to the 2019 California Building Energy Efficiency Standards (Title 24, Part 6). Our joint intent is to achieve significant energy savings through the development of reasonable, responsible, and cost-effective code change proposals for the 2019 Title 24 code change cycle.

The Statewide Utility Team is proposing code revisions for the following measures:

- occupant sensing controls in restrooms;
- daylight dimming controls;
- automatic time-switch controls (i.e., commissioning with manual ON setting); and
- general cleanup of code related to indoor controls; including separating the requirement for partial OFF occupant sensing controls in stairwells from the same requirement applied to corridors for a possibility to “cleanly” require partial OFF occupant sensing controls in stairwells but not corridors in the alteration code.

The “Daylight Dimming Plus OFF” measure proposes to require nonresidential automatic daylight dimming controls to include the OFF step to align with ASHRAE 90.1-2016. The proposed daylighting dimming plus OFF control step will be mandatory and apply to the luminaires in the Primary Sidelit Daylit Zone and the Skylit Daylit Zone. For new construction and alteration nonresidential lighting projects that use prescriptive approach (vs. performance approach) to comply with Title 24, Part 6 code, the proposed daylighting plus OFF control step would be required for the luminaires in the Secondary Sidelit Daylit Zone. For the sake of keeping the code language simpler, the Statewide Utility Team does not recommend an exception for Secondary Sidelit Daylit Zone.

The “Occupant Sensing Controls in Restrooms” measure proposes mandatory occupant sensing full OFF controls in nonresidential restrooms to be more aligned with ASHRAE 90.1-2016.

**The Statewide Utility Team is requesting feedback on the draft code language presented in this document.** Input we receive will inform the code change proposal that the Statewide Utility Team will be proposing to the California Energy Commission in April 2017.

To provide feedback, please email us at [info@title24stakeholders.com](mailto:info@title24stakeholders.com) or contact the measure lead at:

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For more information about the California Statewide Utility Codes and Standards Team's 2019 Title 24, Part 6 advocacy efforts, and the latest information on this code change proposal please visit:  
[www.title24stakeholders.com](http://www.title24stakeholders.com).

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## 2. DRAFT CODE LANGUAGE

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The proposed changes to the Standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2016 documents are marked with underlining (new language) and ~~strikethroughs~~ (deletions).

The proposed code changes are also color coded according to which measure they are addressing:

- occupant sensing controls in restrooms;
- daylight dimming controls;
- automatic time-switch controls (i.e., commissioning with manual ON setting);
- lighting alterations (separating the requirement for partial OFF occupant sensing controls in stairwells from the same requirement applied to corridors); and
- general cleanup of code related to indoor controls.

### 2.1 Standards

Please note that Title 24, Part 6, Section 130.1 Mandatory Indoor Lighting Controls is reproduced in full below with the recommended changes aimed to simplify the code language or retire the portions of the code no longer relevant (with the advance of Solid State Lighting technology). Note that the proposed changes above to the code language related to the “Daylight Dimming Plus OFF,” “Occupant Sensing Controls in Restrooms,” and “Manual ON for Automatic Time-Switch” measures are included below for completeness.

#### SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

Nonresidential, high-rise residential and hotel/motel buildings shall comply with the applicable requirements of Sections 130.1(a) through 130.1(e).

No control shall override energy saving features of any of the required lighting controls in this Section.

**EXCEPTION:** The timed override control in Section 130.1(c)3B may override the automatic time-switch control but no other required lighting control.

(a) Area Controls.

1. All luminaires shall be functionally controlled with manual ON and OFF lighting controls. Each area enclosed by ceiling-height partitions shall be independently controlled.

**EXCEPTION to Section 130.1(a)1:** Up to 0.2 watts per square foot of lighting in any area within a building may be continuously illuminated to allow for means of egress illumination, if:

- A. The area is designated for means of egress on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1; and
- B. The controls for the egress lighting are not accessible to unauthorized personnel.

2. The lighting controls shall meet the following requirements:
  - A. Be readily accessible; and
  - B. Be operated with a manual control that is located in the same room or area with the lighting that is controlled by that lighting control.

**EXCEPTION 1 to Section 130.1(a)2:** In malls and atria, auditorium areas, retail merchandise sales areas, wholesale showroom areas, commercial and industrial storage areas, general commercial and industrial work areas, 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 area being lit is annunciated.

**EXCEPTION 2 to Section 130.1(a)2:** Public restrooms having two or more stalls, parking areas, stairwells, and corridors may use a manual control not accessible to unauthorized personnel.

3. **Other Lighting Controls.**

- A. Other lighting controls may be installed in addition to the manual lighting controls provided they do not override the functionality of controls installed in accordance with Section 130.1(a)1, 2, or 4.

4. **Separately Controlled Lighting Systems.** In addition to the requirements in Section 130.1(a)1, 2, and 3:

- A. General lighting shall be separately controlled from all other lighting systems in an area.
  - B. 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.
  - C. When track lighting is used, general, display, ornamental, and special effects lighting shall each be separately controlled.

- (b) **Multi-Level Lighting Controls.** The general lighting of any enclosed area 100 square feet or larger, with a connected lighting load that exceeds 0.5 watts per square foot shall provide multi-level lighting control that meets the following requirements:

1. Lighting shall have the required number of control steps and meet the uniformity requirements in accordance with TABLE 130.1-A;
    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. Dimmable luminaires shall be controlled by a dimmer control that is capable of controlling lighting through all required lighting control steps and that allows the manual ON and OFF functionality required by Section 130.1(a).

**EXCEPTION 1 to Section 130.1(b):** Classrooms with a connected general lighting load of 0.7 watts per square foot or less and public restrooms shall have at least one control step between 30-70 percent of full rated power.

**EXCEPTION 2 to Section 130.1(b):** An area enclosed by ceiling height partitions that has only one luminaire with no more than two lamps.

**EXCEPTION 3 to Section 130.1(b):** The areas specified in Sections 130.1(c)6, 130.1(c)7 and 130.1(c)8 are not also required to meet the requirements of Section 130.1(b).

(c) **Shut-OFF Controls**

1. In addition to lighting controls installed to comply with Sections 130.1(a) and (b), all installed indoor lighting shall be equipped with controls that meet the following requirements:
  - A. Shall be controlled with an occupant sensing control, automatic time-switch control, or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and
  - B. Separate controls for the lighting on each floor, other than lighting in stairwells; and
  - C. Separate controls for a space enclosed by ceiling height partitions not exceeding 5,000 square feet; and

**EXCEPTION to Section 130.1(c)1C:** In the following function areas the area controlled may not exceed 20,000 square feet: Malls, auditoriums, single tenant retail, industrial, convention centers, and arenas,

- D. Separate controls for general, display, ornamental, and display case lighting.

**EXCEPTION 1 to Section 130.1(c)1:** Where the lighting is serving an area that is in continuous use, 24 hours per day/365 days per year.

**EXCEPTION 2 to Section 130.1(c)1:** Lighting complying with Section 130.1(c)5 or 7.

**EXCEPTION 3 to Section 130.1(c)1:** Up to 0.1 watts per square foot of lighting in any area within a building may be continuously illuminated, provided that the area is designated for means of egress on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1.

**EXCEPTION 4 to Section 130.1(c)1:** Electrical equipment rooms subject to Article 110.26(D) of the California Electrical Code.

**EXCEPTION 5 to Section 130.1(c):** Illumination provided by lighting equipment that is designated for emergency lighting, connected to an emergency power source or battery supply, and is intended to function in emergency mode only when normal power is absent.

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

**EXCEPTION 1 to Section 130.1(c)2:** ~~Single-stall bathrooms less than 70 square feet, and closets~~ Closets less than 70 square feet may use countdown timer switches with a maximum setting capability of ten minutes to comply with the automatic shut-Off requirements.

**EXCEPTION 2 to Section 130.1(c)2:** Lighting in a Server Aisle in a Server Room, as defined in Section 100.1, may use countdown timer switches with a maximum setting capability of 30 minutes to comply with the automatic shut-OFF requirements.

3. If an automatic time-switch control, other than an occupant sensing control, is installed to comply with Section 130.1(c)1, it shall incorporate all of the following features: an override lighting control that

A. Each space shall have an area control that ~~Complies~~ complies with Section 130.1(a) and is capable of turning lights OFF; and

B. ~~Allows~~ Area controls are capable of initiating a timed override of the time switch control. When the area control turns lights ON during normally unoccupied periods, the lighting to shall remain ON for no more than 2 hours when after an override is initiated; and

C. Automatic time-switch is manual-ON. Even during normally occupied hours, lights must be manually turned on.

**EXCEPTION to Section 130.1(c)3B:** In the following function areas, the override time may exceed 2 hours: Malls, auditoriums, single tenant retail, industrial, and arenas where captive-key override is utilized.

**EXCEPTION to Section 130.1(c)3C:** Automatic ON time-switch control is allowed in the following function spaces: industrial, single tenant retail, malls, auditoriums, concourses, lobbies and other areas open to the general public.

4. If an automatic time-switch control, other than an occupant sensing control, is installed to comply with Section 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.

**EXCEPTION to Section 130.1(c)4:** In retail stores and associated malls, restaurants, grocery stores, churches, and theaters, the automatic time-switch control is not required to incorporate an automatic holiday shut-OFF feature.

5. **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, and conference rooms of any size, and restrooms of any size, lighting shall be controlled with occupant sensing controls to automatically shut OFF all of the lighting when the ~~room~~ space is unoccupied. In addition, area controls shall be provided that allow the lights to be manually shut-OFF in accordance with Section 130.1(a) regardless of the sensor status.

~~In areas required by Section 130.1(b) to have multi-level lighting controls, the occupant~~ Occupant sensing controls shall function either as a:

A. Partial-ON Occupant Sensor capable of automatically activating between 50-70 percent of controlled lighting power, or

B. Manual-ON Vacancy Sensor - where all lighting responds to a manual ON input only.

**Exception to 130.1(c)5A&B:** In areas not required by Section 130.1(b) to have multi-level lighting controls, lighting is permitted to be controlled by an occupancy sensor that automatically turns ON all lighting when the room is occupied

~~In areas not required by Section 130.1(b) to have multi-level lighting controls, the occupant sensing controls shall function either as a:~~

~~A. Occupant Sensor; or~~

~~B. Partial-ON Occupant Sensor; or~~

~~C. Vacancy Sensor, where all lighting responds to a manual ON input only.~~

~~In addition, controls shall be provided that allow the lights to be manually shut OFF in accordance with Section 130.1(a) regardless of the sensor status.~~

6. **Areas where full or partial OFF occupant sensing controls are required.** Lighting installed in the following areas shall meet the following requirements in addition to complying with Section 130.1(c)1.
- A. In aisle ways and open areas in warehouses, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power of each luminaire 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.
- ~~**EXCEPTION 1 to Section 130.1(c)6A:** 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.~~
- ~~**EXCEPTION 2 to Section 130.1(c)6A:** 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.~~
- B. In library book stack aisles 10 feet or longer that are accessible from only one end, and library book stack aisles 20 feet or longer that are accessible from both ends, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power of each luminaire 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.
- C. Lighting installed in corridors ~~and stairwells~~ shall be controlled by occupant sensing controls that separately reduce the lighting power of each luminaire 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 when entered from all designed paths of egress.
- D. Lighting installed in stairwells shall be controlled by occupant sensing controls that separately reduce the lighting power of each luminaire 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 when entered from all designed paths of egress.
7. **Areas where partial OFF occupant sensing controls are required.** Lighting installed in the following areas shall meet the following requirements instead of complying with Section 130.1(c)1.
- A. Lighting in ~~stairwells and~~ common area corridors that 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 of each luminaire 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 when entered from all designed paths of egress.

**EXCEPTION to Section 130.1(c)7A:** 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.

**B.** Lighting in stairwells that 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 of each luminaire 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 when entered from all designed paths of egress.

**BC.** In parking garages, parking areas and loading and unloading areas, general lighting shall be controlled by occupant sensing controls having at least one control step that reduces the lighting power of each controlled luminaire to between 20 percent and 50 percent of design lighting power. No more than 500 watts of rated lighting power shall be controlled together as a single zone. ~~A reasonably uniform level of illuminance shall be achieved in accordance with the applicable requirements in TABLE 130.1-A.~~ 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 when entered from all designed paths of egress.

Interior areas of parking garages are classified as indoor lighting for compliance with Section 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 Section 130.2.

**EXCEPTION to Section 130.1(c)7B:** ~~Metal halide luminaires with a lamp plus ballast mean system efficacy of greater than 75 lumens per watt, used for general lighting in parking garages, parking areas and loading and unloading areas, shall be controlled by occupant sensing controls having at least one control step between 20 percent and 60 percent of design lighting power.~~

8. Hotel 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 to Section 130.1(c)8:** One high efficacy luminaire as defined in TABLE 150.0-A that is switched separately and where the switch is located within 6 feet of the entry door.

**(d) Automatic Daylighting Controls.**

1. Daylit Zones shall be defined as follows:

**A. SKYLIT DAYLIT ZONE** is the rough area in plan view under each skylight, plus 0.7 times the average ceiling height in each direction from the edge of the rough opening of the skylight, minus any area on a plan beyond a permanent obstruction that is taller than the following: ~~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.

For skylight(s) located in an atrium, the skylit daylit zone shall include the floor area directly under the atrium, and the top floor that is directly under the skylight, plus 0.7 times the average ceiling height for that floor, in each direction from the edge of the rough opening of the skylight, minus any area on a plan beyond a permanent obstruction that is taller than one-half the distance from the top floor to the bottom of the skylight.

**EXCEPTION 1 to 130.1(d)1B&C:** Areas under skylights where it is documented that existing adjacent structures or natural objects block direct sunlight for more than 1,500 daytime hours per year between 8 a.m. and 4 p.m.

- B. **PRIMARY SIDELIT DAYLIT ZONE** is the area in plan view and is directly adjacent to each vertical glazing in an exterior wall, 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 vertical obstruction that is 6 feet or taller as measured from the floor.
- C. **SECONDARY SIDELIT DAYLIT ZONE** is the area in plan view ~~and is~~ directly adjacent to the primary sidelit daylit zone ~~each vertical glazing, and extends~~ two window head heights deep into the area, and is the 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 vertical obstruction that is 6 feet or taller as measured from the floor.

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

**EXCEPTION to 130.1(d)1B&C:** Areas adjacent to windows with overhangs and no clerestory above the overhang, where the ratio of the Overhang Projection to the Window Head Height is greater than 1.0.

- 2. 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 requirements of Section 110.9, and the applicable requirements below:
  - A. All Skylit Daylit Zones and Primary Sidelit Daylit Zones shall be shown on the 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.
  - D. **Automatic Daylighting Control Installation and Operation.** For luminaires providing general lighting in daylight zones, automatic daylighting controls shall be installed and configured to operate according to all of the following requirements:
    - i. Photosensors shall be located so that they are not readily accessible to unauthorized personnel. The location where calibration adjustments are made to automatic daylighting controls shall be readily accessible to authorized personnel and may be inside a locked case or under a cover which requires a tool for access.

- ii. Automatic daylighting controls shall provide functional multilevel lighting having at least the number of control steps specified in TABLE 130.1-A.

**EXCEPTION 1 to Section 130.1(d)2Dii:** Controlled lighting having a lighting power density less than  $0.3 \text{ W/ft}^2$  is not required to provide multilevel lighting controls.

- iii. 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.
- iv. In areas served by lighting that is daylight controlled, when the daylight illuminance 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.

v. In areas served by lighting that is daylight controlled, when the daylight illuminance is greater than 200 percent of the design illuminance received from the general lighting system at full power, the general lighting power in that daylight zone shall be turned OFF.

**EXCEPTION 1 to Section 130.1(d)2:** 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.

**EXCEPTION 2 to Section 130.1(d)2:** Rooms that have a total glazing area of less than 24 square feet.

**EXCEPTION 3 to Section 130.1(d)2:** Parking garages complying with Section 130.1(d)3.

- 3. **Parking Garage Daylighting Requirements.** In a parking garage area with a combined total of 36 square feet or more of glazing or opening, luminaires providing general lighting that are in the combined primary and secondary sidelit daylit zones shall be controlled independently from other lighting in the parking garage by automatic daylighting controls, and shall meet the following requirements as applicable:
  - A. All primary and secondary sidelit daylit zones shall be shown on the 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. The location where calibration adjustments are made to the automatic daylighting controls shall be readily accessible to authorized personnel but may be inside a locked case or under a cover which requires a tool for access.
    - ii. Automatic daylighting controls shall be multilevel, 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 illuminance levels measured at the farthest edge of the secondary sidelit zone away from the glazing or opening are greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power consumption shall be zero.

**EXCEPTION 1 to Section 130.1(d)3:** Luminaires located in the daylight transition zone and luminaires for only dedicated ramps. Daylight transition zone and dedicated ramps are defined in Section 100.1.

**EXCEPTION 2 to Section 130.1(d)3:** The total combined general lighting power in the primary sidelit daylight zones is less than 60 watts.

(e) **Demand Responsive Controls.**

1. Buildings larger than 10,000 square feet, after excluding spaces with a lighting power density of 0.5 watts per square foot or less, shall be capable of automatically reducing lighting power in response to a Demand Response Signal; so that the total lighting power of non-excluded spaces can be lowered by a minimum of 15 percent below the total installed lighting power when a Demand Response Signal is received. ~~Lighting shall be reduced in a manner consistent with uniform level of illumination requirements in TABLE 130.1-A.~~

**EXCEPTION to Section 130.1(e):** Lighting not permitted by a health or life safety statute, ordinance, or regulation to be reduced shall not be counted toward the total lighting power.

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

TABLE 130.1-A *MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS*

Luminaire Type	Minimum Required Control Steps (percent of full rated	Uniform level of illuminance shall be achieved by:
Line-voltage sockets except GU-24	Continuous dimming 10-100 percent	
Low-voltage incandescent systems		
LED luminaires and LED source systems		
GU-24 rated for LED		
GU-24 sockets rated for fluorescent > 20 watts	Continuous dimming 20-100 percent	
Pin-based compact fluorescent > 20 watts <sup>2</sup>		
GU-24 sockets rated for fluorescent ≤ 20 watts	Minimum one step between 30-70 percent	Stepped dimming; or Continuous dimming; or Switching alternate lamps in a luminaire
Pin-based compact fluorescent ≤ 20 watts <sup>2</sup>		
Linear fluorescent and U-bent fluorescent ≤ 13 watts		

Luminaire Type	Minimum Required Control Steps (percent of full rated	Uniform level of illuminance shall be achieved by:
Linear fluorescent and U-bent fluorescent >13 watts	<del>Minimum one step in each</del>	<del>Stepped dimming; or</del>
	<u>Continuous dimming 20-100 percent</u>	<del>Continuous dimming; or</del>
	<del>20-40 %</del>	<del>Switching alternate lamps</del>
	<del>50-70 %</del>	<del>in each luminaire, having a minimum of 4 lamps per luminaire illuminating the same area and in the same manner</del>
	<del>75-85 %</del>	
Track Lighting	Minimum one step between  30 – 70 percent	Step dimming; or  Continuous dimming; or  Separately switching circuits in multi-circuit track with a minimum of two circuits.
HID > 20 watts	Minimum one step between  50 - 70 percent	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.
Induction > 25 watts		
Other light sources		
1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor		

## SECTION 140.6 – PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING

### Section 140.6 (d)

**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, and that is not in a Primary Sidelit Daylit Zone shall:

1. Be controlled independently from all other luminaires by automatic daylighting controls that meet the applicable requirements of Section 110.9; and
2. Be controlled in accordance with the applicable requirements in Section 130.1(d)2; and
3. All Secondary Sidelit Daylit Zones shall be shown on the plans submitted to the enforcing agency.

**EXCEPTION 1 to Section 140.6(d):** Luminaires in Secondary Sidelit Daylit Zone(s) in areas where the total wattage of general lighting is less than 120 Watts.

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

TYPE OF CONTROL	TYPE OF AREA	FACTOR
<p>a. To qualify for any of the Power Adjustment Factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2</p> <p>b. Only one PAF may be used for each qualifying luminaire unless combined below.</p> <p>c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF</p>		
1. Daylight Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit	0.10

## 2.2 Reference Appendices

### 2.2.1 Mandatory Automatic Daylight Dimming Plus OFF Controls

For the “Daylight Dimming Plus OFF” measure, 2016 Nonresidential Appendix NA7 “Installation and Acceptance Requirements for Nonresidential Buildings and Covered Processes” will need to be updated (chapter NA7.6.1 Automatic Daylighting Control Acceptance).

#### NA7.6.1 Automatic Daylighting Controls Acceptance Tests

##### NA 7.6.1.1 Construction Inspection

Verify that automatic daylighting controls qualify as one of the required control types, are installed, and fully functional in accordance with each applicable requirement in Section 130.1(d), and list each specific exception claimed, from Section 130.1(d).

### ***NA 7.6.1.2 Functional testing***

All photocontrols serving more than 5,000 ft<sup>2</sup> of daylit area shall undergo functional testing. Photocontrols that are serving smaller spaces may be sampled as follows: For buildings with up to five (5) photocontrols, all photocontrols shall be tested. For buildings with more than five (5) photocontrols, sampling may be done on spaces with similar sensors and cardinal orientations of glazing; sampling shall include a minimum of 1 photocontrol for each group of up to 5 additional photocontrols. If the first photocontrol in the sample group passes the functional test, the remaining building spaces in the sample group also pass. If the first photocontrol in the sample group fails the functional test, the rest of the photocontrols in the group shall be tested. If any tested photocontrol fails the functional test, it shall be repaired, replaced or adjusted until it passes the test.

For each photocontrol to be tested do the following:

(a) Test each group of lights controlled separately by the photocontrol according to the following protocol. In all interior spaces other than parking garages, a separate test shall be conducted for daylighting control of the primary sidelit zone separate from the secondary sidelit zone. A single photocontrol containing a single sensor can control separately the primary sidelit zone from the secondary sidelit zone as long as it has two control channels with different setpoints. The primary sidelit zone will have a different reference location than the secondary sidelit zone.

#### ***NA 7.6.1.2.1 Continuous Dimming Control Systems***

This requirement is for systems that have more than 10 levels of controlled light output in a given zone.

(a) Identify the minimum daylighting location in the controlled zone (Reference Location). This can be identified using either the illuminance method or the distance method.

##### ***Illuminance Method***

(b) Turn OFF controlled lighting and measure daylight illuminance within zones illuminated by controlled luminaires.

(c) Identify the Reference Location; this is the task location with lowest daylight illuminance in the zone illuminated by controlled luminaires. This location will be used for illuminance measurements in subsequent tests.

##### ***Distance Method***

Identify the task location within the zone illuminated by controlled luminaires that is farthest away from daylight sources. This is the Reference Location and will be used for illuminance measurements in subsequent tests.

(d) No daylight test. Simulate or provide conditions without daylight. Verify and document the following:

1. Automatic daylight control system provides appropriate control so that electric lighting system is providing full light output unless otherwise specified by design documents.
2. Document the reference illuminance, which is the electric lighting illuminance level at the reference location identified in Step 1.
3. Light output is stable with no discernable flicker.

(e) Full daylight test. Simulate or provide bright conditions. Note one can shine a flashlight or other bright source into the light sensor for this test. Verify and document the following:

1. For all applications: Controlled lighting in the daylit zone is turned OFF.

2. Only luminaires in daylit zones are affected by daylight control. If the daylighting controls control lighting outside of the daylight zones including those behind obstructions as described in Section 130.1(d)1, the control system is not compliant.

3. If a Power Adjustment Factor is claimed for Daylight Dimming plus OFF controls in accordance with Section 140.6(a)2H, compliant systems shall automatically turn OFF the luminaires that are receiving this credit. This portion of the full daylight test does not apply to lighting systems that are not claiming a Power Adjustment Factor for Daylight Dimming plus OFF controls.

(f) Partial daylight test. Simulate or provide daylight conditions where illuminance (fc) from daylight only at the Reference Location is between 60 and 95 percent of Reference Illuminance (fc) documented in Step

2. Verify and document the following:

1. Measure that the combined illuminance of daylight and controlled electric lighting (fc) at the reference location is no less than the electric lighting illuminance (fc) at this location during the no daylight test documented in Step (d)2.

2. Measure that the combined illuminance of daylight and controlled electric lighting (fc) at the Reference Location is no greater than 150 percent of the reference illuminance (fc) documented in Step (d)2.

3. Light output is stable with no discernable flicker.

#### ***NA 7.6.1.2.2 Stepped Switching or Stepped Dimming Control Systems***

This requirement is for systems that have no more than 10 discrete steps of control of light output.

If the control has 3 steps of control or less, conduct the following tests for all steps of control. If the control has more than 3 steps of control, testing 3 steps of control is sufficient for showing compliance.

(a) Identify the minimum daylighting location(s) in the controlled zone. (Reference Location). This can be identified using either the illuminance method or the distance method.

##### ***Illuminance Method***

1. Turn OFF controlled lighting and measure daylight illuminances within a zone illuminated by controlled luminaires.

2. Identify the reference location; this is the task location with lowest daylight illuminance in the zone illuminated by controlled luminaires. This location will be used for illuminance measurements in subsequent tests.

3. Turn controlled lights back ON.

##### ***Distance Method***

1. Identify the task location within the zone illuminated by controlled luminaires that is farthest away from daylight sources. This is the reference location and will be used for illuminance measurements in subsequent tests.

(b) No daylight test. Simulate or provide conditions without daylight for a stepped switching or stepped dimming control system. Verify and document the following: 1. If the control is manually adjusted (not self commissioning), make note of the time delay and override time delay or set time delay to minimum setting. This condition shall be in effect through step 4.

2. Automatic daylight control system turns ON all stages of controlled lights unless it is documented that multi-level luminaires have been "tuned" to less than full output and providing design illuminance (fc) levels
3. Stepped dimming control system provides reduced flicker over the entire operating range as specified by §110.9.
4. Document the reference illuminance which is the electric lighting illuminance level measured at the reference location identified in Step 1.

(c) Full daylight test. Simulate or provide bright conditions. Note one can shine a flashlight or other bright source into the light sensor for this test. Verify and document the following:

**1. For all applications: Controlled lighting in the daylit zone is turned OFF.**

2. Only luminaires in daylit zones (toplit zone, primary sidelit zone and secondary sidelit zone) are affected by daylight control. If the daylighting controls control lighting outside of the daylight zones including those behind obstructions as described in Section 130.1(d)1, the control system is not compliant.

(d) Partial daylight test. For each control stage that is tested in this step, the control stages with lower setpoints than the stage tested are left ON and those stages of control with higher setpoints are dimmed or controlled off. Simulate or provide conditions so that each control stage turns on and off or dims. Verify and document the following for each control stage:

1. Document the total daylight and electric lighting illuminance level measured at its reference location just after the stage of control dims or shuts off a stage of lighting:
  - A. The total measured illumination shall be no less than the reference illuminance measured at this location during the no daylight test documented in Step 2.
  - B. The total measured illumination shall be no greater than 150 percent of the reference illuminance.
2. The control stage shall not cycle on and off or cycle between dim and undimmed while daylight illuminance remains constant.
3. Only luminaires in daylit zones (toplit zone, primary sidelit zone, and secondary sidelit zone) are affected by daylight control.

(e) Verify time delay.

1. Verify that time delay automatically resets to normal mode within 60 minutes.
2. Set normal mode time delay to at least three minutes.
3. Confirm that there is a time delay of at least 3 minutes between the time when illuminance exceeds the setpoint for a given dimming stage and when the control dims or switches off the controlled lights.

## **2.2.2 Mandatory Occupant Sensing Full OFF Controls in Nonresidential Restrooms**

For the "Occupant Sensing Controls in Restrooms" measure, there are no proposed changes to the Reference Appendices.