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2019 Nonresidential Lighting Indoor Lighting Controls

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Pre-Rulemaking Workshop

Hearing Room A

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Acknowledgments

We appreciate the work of the Statewide Utility Codes and Standards Team (CASE Team) in developing these proposals.



Indoor Lighting Controls

Scope

- Automatic Daylight Dimming Plus OFF Controls (referred to as “Daylight Dimming Plus OFF” for short throughout the report),
- • Mandatory Occupant Sensing Full OFF Controls in Nonresidential Restrooms (referred to as “Occupant Sensing Controls in Restrooms”),
- • Manual ON Commissioning for Automatic Time-Switch Controls (referred to as “Manual ON Time-Switch”), and
- • Nonresidential Indoor Lighting Code Language Cleanup and Alignment with ASHRAE 90.1-2016.



Indoor Lighting Controls

Measure Name	Type of Requirement	Modified Section(s) of Title 24, Part 6	Modified Title 24, Part 6 Appendices	Will Compliance Software Be Modified	Modified Compliance Document(s)
Daylight Dimming Plus OFF Controls in Primary and Skylit Zones	Mandatory	Section 130.1(d) Section 140.6(d)	NA7.6.1 Automatic Daylighting Control Acceptance	Yes	2016-NRCA-LTI-03-A Automatic Daylighting Control Acceptance Document
Daylight Dimming Plus OFF Controls in Secondary Zones	Prescriptive	Section 140.6(d)	N/A	Yes	N/A
Occupant Sensing Controls in Restrooms	Mandatory	Section 130.1(c)	NA7.6.2	No	NRCC-LTI-02-E "Mandatory Declaration Statements"
Manual ON Time-Switch Controls	Mandatory	Section 130.1	N/A	No	N/A
Nonresidential Indoor Lighting Code Language Cleanup and Alignment with ASHRAE 90.1-2016	Mandatory	Section 100.1 Section 130.1 Section 140.1	NA 7.6.1.2.1	No	N/A



Indoor Lighting Controls

Specific 90.1-2016 Disagreements

- Lighting power wattage exception: recommends leaving the Title 24, Part 6 lighting power exemption in place as opposed to harmonizing with ASHRAE 90.1-2016. The cost of energy is more expensive in California and Title 24, Part 6 uses a lower discount rate than ASHRAE-90.1, which allows for a lighting power wattage to be cost-effective.
- Total glazing area exception: recommends leaving the Title 24, Part 6 glazing exemption in place as opposed to harmonizing with ASHRAE 90.1-2016 for code simplicity.



Indoor Lighting Controls

Mandatory Occupant Sensing Full OFF Controls in Nonresidential Restrooms

- Mandatory occupant sensing full OFF controls in nonresidential restrooms to be aligned with ASHRAE 90.1-2016.
- Recommends that Chapter 5 in the 2019 Nonresidential Compliance Manual include guidance on the appropriate occupancy sensor technology based on the size and configuration of the nonresidential restroom.



Indoor Lighting Controls

Mandatory Occupant Sensing Full OFF Controls in Nonresidential Restrooms Stakeholder Concern

- Larger, multi-stall restrooms consider zoning and install more than one dual-technology occupancy sensor to avoid false OFFs. Occupancy sensing technology and the layout of the space should be discussed in the compliance manual.



Indoor Lighting Controls

Manual ON Commissioning for Automatic Time-Switch Controls

- Automatic time-switch controls to comply with Section 130.1(c), be commissioned as manual ON. This proposal would exempt automatic time-switch controls used in industrial, single tenant retail, malls, auditoriums, concourses, lobbies and other areas open to the general public. It will reduce the amount of time that nonresidential indoor lighting is turned ON when there are no occupants present in the space.
- Does not prevent automatic time-switches from being reprogrammed to use automatic ON setting after acceptance testing and commissioning are completed.



Indoor Lighting Controls

Nonresidential Indoor Lighting Code Language Cleanup and Alignment with ASHRAE 90.1-2016

- Increase minimum dimming level in classrooms
- Consolidate automatic daylighting dimming controls to Section 130.1



Indoor Lighting Controls

Section 130.1(b) Multi-Level Controls.

- Replace "enclosed area," which is not a defined term, with "enclosed space," which is a defined term in Section 100.1 Definitions.
- Delete EXCEPTION 1 to Section 130.1(b). Classroom lighting is proposed to be no longer exempted at the higher 0.7 W/ft² with simple multi-level controls.
- EXCEPTION 2 to Section 130.1(b). Adds applications complying with Section 130.1(c)7 and Section 130.1(c)8 to the exception for continuous dimming controls. The current exception only includes applications complying with Section 130.1(c)6.



Indoor Lighting Controls

Multi-Level Lighting Controls. The general lighting of any enclosed ~~area~~ space 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:

- Lighting shall have the required number of control steps and meet the uniformity requirements in accordance with TABLE 130.1-A;
- 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
- 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).



Indoor Lighting Controls

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

EXCEPTION ~~2-1~~ to Section 130.1(b): An area enclosed by ceiling height partitions that has only one luminaire with no more than two lamps.

EXCEPTION ~~3-2~~ 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).

EXCEPTION 3 to Section 130.1(b): Restrooms



Indoor Lighting Controls

Section 130.1(c)1C Separate Shut-off Controls

- Clarify the intent of the square footage limits per control. The direct intent of this section is that separate controls [are required] for each space enclosed by ceiling height partitions; and no greater than 5,000 square feet of lighting is controlled by each control. Consider changing the criterion from sf to watts.
- Clarify the exception: In Malls, auditoriums, single tenant retail, industrial, convention centers, and arenas, with separate controls for each space and no greater than 20,000 square feet of lighting is controlled by each control. Also convert the maximum controlled area from 20,000 square feet to 15,000 watts of controlled power.



Indoor Lighting Controls Proposed Language

(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 each space enclosed by ceiling height partitions; and no greater than not exceeding 5,000 square feet 3,000 watts of lighting is controlled by each control; 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, with separate controls for each enclosed space and no greater than 15,000 Watts of lighting controlled by each control.

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



Indoor Lighting Controls

Section 130.1 (c), Mandatory Indoor Lighting Controls

- Shut-OFF Controls: add a mandatory requirement for occupant sensing full OFF controls in nonresidential restrooms to capture energy savings when restrooms are unoccupied.
- Add 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.
- Automatic time-switches shall be commissioned as manual ON, with the exception of several function spaces that are open to the general public.



Indoor Lighting Controls

Section 130.1(c)3 Manual ON Time Switch Controls

- Change as follows: “Time switch control, ~~other than an occupant sensing control...~~” The language causes confusion as it implies there is a time switch control that is an occupancy control.
- Clarify that the area control in each room is capable of manually turning lights OFF.
- Clarify the timed override of the time clock control by the area control.
- A new requirement in which time-switch controls are manual ON for most occupancies.



Indoor Lighting Controls

Section 130.1(d), Mandatory Indoor Lighting Controls, Automatic Daylighting Controls

- Add mandatory requirement for Skylit Daylit Zone and Primary Sidelit Daylit Zone including OFF step in automatic daylight dimming controls with an exemption for classroom areas and Primary and Secondary Sidelit retail spaces. Also applies to Secondary Sidelit Daylit Zone for projects using the prescriptive approach.
- Require lights being turned off when daylight illuminance exceeds 150 percent of design illuminance.



Indoor Lighting Controls

Section 130.1(c)4

- Renumber Section 130.1(c)3D as it is another requirement of time-switch controls.
- Renumber the remainder of Section 130.1 as needed.
- Correct references made to Section 130.1 from Section 141.0(b)2I, J, and K (lighting and wiring alterations).



Indoor Lighting Controls

Section 130.1(c)5 Areas where Occupant Sensing Controls are required to shut OFF All Lighting

- Require restrooms to be controlled by occupancy controls.
- Remove the term "room," since a defined term for a room is an "enclosed space" or "space."
- Clarify that area controls shall be capable of turn OFF lights even when occupancy is detected. Move this feature from the bottom of the requirements to earlier in this section.
- Simplify the area control (manual ON or partial ON) requirements by including an exception for controls that are exempted from Section 130.1(b).
- Added the term "manual ON" to better reflect the terms used by industry practitioners. Redefine the term "vacancy sensor" to permit field adjustable occupancy/vacancy. Also affects Title 20..



Indoor Lighting Controls

Section 130.1(c)6 Areas where full or partial OFF occupant sensing controls are required

- Remove Exceptions to Section 130.1(c)6A for controls that reduce power by 40 percent if they are less than 80 percent of area category LPD or if they are HID lighting.
- In items A through D, add clarifying language to the phrase "reduce lighting power of each luminaire."
- In items C and D, add language to allow reducing lighting power when the space is vacant but other portions of the path of egress are occupied. Item D to call out stairwells (controls retrofit when altering luminaires) as separate from corridors (controls not required to be retrofitted when altering luminaire).



Indoor Lighting Controls

Section 130.1(c)7 Areas where partial OFF occupant sensing controls are required

- Lighting in common area corridors that provide access to guestrooms.
 - Require all corridors to have, at a minimum, partial OFF controls that require that power is reduced by at least 50 percent when no activity is detected in a corridor for longer than 20 minutes.
 - Include the phrase "reduce lighting power of each luminaire".
 - Add language to provide the flexibility to reduce lighting power when a space is vacant but other portions of the path of egress are occupied. "... 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".
- Separate stairwells from corridors so stairwell controls can be called out as part of lighting retrofits. Corridors are more difficult to retrofit motion controls, due to hard ceilings, small wattage luminaires and aesthetic considerations.
- Change requirements for parking garages, parking areas and loading and unloading areas to match Section 130.1(c)6.
- Adding clarifying language to the phrase "reduce lighting power of each luminaire."



Indoor Lighting Controls

Section 130.1(d)1A. Skylit Daylit Zone Definition

- Remove the introductory language, which was intended for a list of items but there is only one item.
- Add a definition of daylit zone for atria.
- Exempting areas under skylights that are shaded at least half of the time (1,500 hours) during the timeframe of 8 a.m. to 4 p.m.



Indoor Lighting Controls

Section 130.1(d)1B. Primary Sidelit Daylit Zone Definition

- Clarify that the term “glazing” is only located in an exterior wall and does not define sidelit zones near interior windows.
- Replace the term "window" with "vertical fenestration" which includes glass doors.
- Add the term “vertical” to clarify that this zone does not include areas that are obstructed by vertical obstructions. This clarifies that horizontal obstructions (like light shelves) do not reduce the areas of the sidelit zone.
- Any area in a Skylit Daylit Zone is should be subtracted from the Primary Sidelit Daylit Zone to avoid double counting of areas and to provide clarity on how lights are grouped together for separate control of lighting by daylighting controls.



Indoor Lighting Controls

Section 130.1(d)1C. Secondary Sidelit Daylit Zone Definition

- Change secondary Sidelit Zones definition to be similar to Primary Sidelit Zone. This includes clarifying the terms vertical fenestration and vertical obstructions.
- Any lights in a Skylit Zone or Primary Sidelit zone are subtracted from the Secondary Sidelit Daylit Zone to avoid double counting of areas and to provide clarity on how lights are grouped together for separate control of lighting by daylighting controls. The proposed definition eliminates any overlapping skylit and primary sidelit zones.



Indoor Lighting Controls

EXCEPTION to 130.1(d)1B & C

- Provide an exception for areas near windows from being considered as primary or secondary sidelit zone when the horizontal projection of overhang distance is equal to the window head height. Energy savings are reduced by around 50 percent when the ratio of the overhang projection to the window head height is 1.0 or greater.
- The exception does not apply if there is glazing above the overhang (e.g., a clerestory above an exterior lightshelf).



Indoor Lighting Controls

Section 130.1(d)2 Daylighting Controls

- Move the prescriptive daylighting control requirements from Section 140.6(d) to Section 130.1(d)2.
- Remove Section 130.1(d)2C. The proposed definition ensures there are no longer any overlapping areas (see Section 130.1(d)1B & C).
- Remove Section 130.1(d)2D and renumbering the following item (Section 130.1(d)2C (old Section 130.1(d)2D). Add the term "general lighting," in response to reports that designers and acceptance testing agents are not cognizant of fact that the requirements only apply to general lighting.
- Change 130.1(d)2Ciii to refer to "daylit zone" rather than "space."
- Change 130.1(d)2Civ where lights are dimmed to 35 percent of rated power to 125 percent of design illuminance. Require lights to be turned OFF when daylight illuminance exceeds 150 percent of design illuminance.
- Change 130.1(d)2Cv to add "plus-OFF" portion of the daylighting controls and allows a daylight "gap" of 25 percent of design illuminance between the minimum dimming level and turning lights completely OFF.
- Change EXCEPTION 2 to Section 130.1(d)2 to clarify that no daylight controls are required in the Secondary Sidelit Zone and better define when controls are exempted in the Secondary Sidelit Zone.



Indoor Lighting Controls

Section 130.1 (e) Demand Responsive Controls.

- Strike the following sentence: “Lighting shall be reduced in a manner consistent with uniform level of illumination requirements in TABLE 130.1-A.” This requirement can be advantageous in applications, such as ornamental display, or displays in retail or restaurants. However, the language “uniform manner” over-specifies how projects choose to reduce their lighting power.



Indoor Lighting Controls

- **New Section 130.1 (f) Controls Coordination.**
- No control shall override any of the required lighting controls in Section 130.1 that results in an increase in the energy consumption...
- Additional controls can be included that reduce energy consumption.
- **Exception 1.** Override 2 hour sweep in certain occupancies indefinitely, if they have a captive key switch.
- **Exception 2.** Permit certain time-switch controls that can turn lights ON in, "industrial, single tenant retail, malls, auditoriums, concourses, lobbies and other areas open to the general public."
- **Exception 3.** An occupancy sensor can only override the manual switch after "the space has been vacated and re-occupied regardless of prior operation of area controls."



Indoor Lighting Controls

Section 140.6(d), Table 140.6-A

- Lighting Power Adjustment Factors (PAF): Revise PAF for daylight dimming plus OFF control to only be applicable to areas that are proposed to be exempt in Section 130.1(d)2C.



Stakeholder Concerns

Daylighting Dimming Plus OFF End-User Questions/Concerns:

If occupants report a problem when the lights are off (but functioning as intended), building operators might disable the daylighting controls to avoid future complaints, even though a simple adjustment or education might accommodate the complaint.

Daylight dimming plus OFF may be in issue in spaces with “fine task” work or personally owned spaces.



Stakeholder Concerns

Daylighting Dimming Plus OFF End-User Questions/Concerns:

Acceptance requirements must be simplified, make sure there are no additional requirements added in the acceptance forms, and provide an explanation on how to do the testing when there are multiple daylight zones (primary and secondary).

Length of time to test for all daylight conditions, which may require multiple site visits to test conditions during the daytime, night time, and when the conditions provide the 60-95% daylight. Systems with auto-calibration can make the task more manageable.



Indoor Lighting Controls

Staff and Consultant Notes

- State Fire Marshall has overruled Part 6 lighting controls requirements when they conflict with Title 24 Part 2 Section 1006 (Egress Lighting and Emergency Egress Lighting), specifically partial off. Partial off does not meet Section 1006.1 unless the lower light level meets egress requirements whenever the building is occupied.



Indoor Lighting Controls

1. What are the exiting and emergency lighting requirements when applying the California Energy Code?

Answer: The California Building Code (CBC) requirements for Means of Egress Illumination Section (§1006) supersede the California Energy Code. The requirements of CBC §1006 are applicable when applying the California Energy Code.

*California State Fire Marshall Code Interpretation
14-010*



Indoor Lighting Controls

Staff and Consultant Notes

- Coordination of lighting controls 130.1(f) deserves considerable thought and may need to be expanded.
- Could it include “network lighting controls”? Is it time to define them?
- Impact on Acceptance Testing is noted in the report. Could Acceptance Testing be simplified and how?



Indoor Lighting Controls

Staff and Consultant Notes

- Daylight switch to off: most drivers dim over 10% to 100% of design. Switch to off will be a noticeable step.
- Drivers offering 1% or 0.1% minimum are more expensive and not necessarily universal.



Submitting Comments

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Questions?