Proposal Summary

Indoor Lighting Controls

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Measure Description

This measure proposes the following revisions to the mandatory control requirement section in the code (Section 130.1) and the associated acceptance test (NA 7.6 in the Reference Appendices). The proposed changes include both updates in the requirements and code language clean-up. Many of the proposed measures also bring the requirements in Title 24, Part 6 into better alignment with the national standards (ASHRAE 90.1) and other model codes (IECC). The first four proposed changes would generate savings and may incur additional costs in implementing the updated requirements; therefore, a full CASE Report will be developed to demonstrate cost-effectiveness. The last proposed changes are code language cleanup and are not likely to result in additional savings or costs. Energy savings estimates and cost and cost-effectiveness analysis will not be performed for these two proposed changes as part of the CASE Report development.

Measures that increase the stringency of code requirements apply only to spaces in nonresidential buildings and do not affect Group R occupancies and common or public use areas.

1) **Parking Garage Daylight Adaptation Zones Nighttime Controls.** This measure ensures proper visual adaptation for drivers entering parking garages at night by requiring lighting in the daylight adaptation zones to reduce the light level to that of the general parking zone from sunset to sunrise.
2) **Require Occupant Sensing Controls in more Spaces.** The space types currently being considered include computer rooms, exercise/fitness and gymnasium areas, financial transaction areas, laboratory, lobby/main entry, and lounge, breakroom, or waiting areas. Additionally, the requirement would trigger occupied standby controls in spaces where ventilation is allowed to be shut off and temperature set back when no occupant is detected. This would result in energy savings from HVAC systems.

3) **Reduce Occupant Sensing Control Delay Time.** This measure would reduce the time delay for occupant sensing controls from the current 20 minutes to 15 minutes.
4) **Update Multilevel Lighting Controls Requirements.** This measure aims to clarify the current code requirements on multilevel lighting controls and update the exceptions to better reflect the current technology. The proposal includes five elements:
    - Improve the code language in specifying manual dimmer requirements
    - Change the trigger for requiring manual dimmers from an LPD basis to a wattage basis to align the metric used for determining controls requirements across all mandatory lighting controls.
    - Revise the threshold for requiring manual dimmers for spaces in nonresidential buildings, which were previously determined based on traditional light sources, to reflect LED lighting technologies. The current proposed threshold is 50 watts for spaces in nonresidential buildings.
    - Remove references to multilevel lighting controls and directly specify continuous dimming capability in other mandatory control sections, such as daylight responsive controls and demand responsive lighting controls.
    - Require all daylight responsive controls to be implemented with continuous dimming, and manual overrides to daylight responsive controls timed or reset at the next ON cycle.
5) **Make the Alternate Partial Daylight Test the only test method for the Daylight Responsive Control Acceptance Test**. This proposed measure would remove the Partial Daylight Test method and make the Alternate Partial Daylight Test the only test method. This simplifies the acceptance test procedure and promotes better compliance with the daylight responsive controls requirements.
6) **Improve the lighting controls acceptance test methods for luminaire-level lighting controls (LLLC).** The proposed measure would improve the acceptance test methods by providing instructions for testing LLLCs when they are used as the control solution to meet the mandatory lighting controls requirements. The improved test method would reduce test burden and increase effectiveness for the Acceptance Test Technicians.

Table 1 summarizes the scope of the proposed code change.

Table 1: Scope of Proposed Code Change

An “X” indicates the proposed code change is relevant.

Building Type(s)		single family
		multifamily
	X	nonresidential
Type of Change	X	mandatory
		prescriptive
		performance
Third Party Verification		no changes to third party verification
	X	update existing verification requirements
	X	add new verification requirements
Construction Type(s)	X	new construction
	X	additions
	X	alterations
Updates to Compliance Software		no updates
	X	update existing feature
	X	add new feature

Justification for Proposed Change

Several of the proposed revisions to the mandatory control requirements would bring Title 24 into alignment with ASHRAE 90.1 lighting requirements and increase energy savings. The nighttime adaptation compensation controls for the parking garage daylight adaptation zone are an existing requirement in ASHRAE 90.1, and such controls are considered a best practice to increase safety from an illuminating engineering standpoint. ASHRAE 90.1 also requires more spaces to implement partial or full OFF occupant sensing controls, and some of those spaces are currently either not required to have occupant sensing controls or not included as an area category in Title 24. Reducing the maximum time delay of occupant sensing controls to 15 minutes saves energy and aligns with the publication of Addendum BD to ASHRAE 90.1-2022, as well as the default settings for many brands of occupant sensors.[1]

[1] https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2022_bd_20250509.pdf

The 0.5 watts per square foot threshold for requiring multilevel lighting controls has been in place since the pre-LED era and was based on traditional light sources. With LEDs' high efficacy and being continuously dimmable with no or minimal additional cost, it would be prudent to recalibrate and revise the threshold based on current technologies. The multilevel lighting control is the only mandatory lighting control requirements that use an LPD-based trigger, while all others use a wattage-based trigger, creating confusion and compliance complexity for market actors. Furthermore, the code language for multilevel lighting controls has been ambiguous as to whether it pertains to continuous dimming that other controls can utilize or a physical dimmer for manual dimming. Since several other mandatory control sections reference multilevel lighting controls, it is essential to clean up the multilevel lighting controls code language to ensure those references are consistent and coherent. The current exception for multilevel lighting controls also creates a conflict with daylight responsive controls when a space is exempted from multilevel lighting controls but is required to implement daylight responsive controls. Without continuous dimming provided by multilevel lighting controls, daylight responsive controls would not be effective, and the resulting behavior could be perceived negatively by the occupant. The proposal of requiring continuous dimming for daylight responsive controls regardless of the multilevel lighting controls exception aims to address this conflict.

Requiring manual overrides of daylight responsive controls to be timed or reset at the next ON cycle is a code cleanup effort to address ambiguity in the current code language that does not clearly specify whether daylight responsive controls can be overridden by any user and how and when daylight responsive controls should resume when overridden.

The Alternate Partial Daylight Test was proposed and adopted in the 2022 T24 energy code as an alternative to the original Partial Daylight Test, as creating a proper test condition for performing the original Partial Daylight Test is often difficult. The intent was for the two test methods to coexist for a few code cycles, allowing Acceptance Test Technicians' (ATTs') to make a smooth transition to the Alternate Partial Daylight Test. It is time to formally remove the less effective Partial Daylight Test to improve acceptance test effectiveness and increase the compliance rate.

Current lighting controls acceptance test methods were designed for zone-based controls, where the lights in the entire zone, e.g., a daylit zone, are controlled by a single sensor. When luminaire-level lighting controls (LLLC) are used as the control solution to meet mandatory control requirements, the sampling rules in current test methods create a test burden, as too many controls would need to be tested. Additionally, the current test methods need to consider the independentedness of each

LLLC luminaire in responding to changing daylight conditions and provide specific instructions for correctly and effectively performing the Full Daylight Test.

Data Needs / Information Requests

The Statewide CASE Team is seeking the following information to inform the code change proposal. Data may be provided anonymously. To participate or provide information, please email Yao-Jung Wen at, ywen@energy-solution.com, directly and copy info@title24stakeholders.com.

- Parking garage daylight adaptation zones nighttime controls
    - Data on the areas (square footage) of daylight adaptation zones in relation to the overall parking structure area.
    - Information on the number of 24/7 and non-24/7 parking garages in California, and the typical operating hours for non-24/7 parking garages to help inform the energy savings estimate.
    - Cost of additional materials and labor to implement nighttime dimming in the daylight adaptation zones.
    - Examples of existing implementations of parking garage daylight adaptation zone nighttime controls in California, providing insights into:
        - Whether daylight adaptation zone lighting is composed of separate/different fixtures from the main parking area lighting.
        - How often do daylight adaptation zone fixtures have dimming capability?
        - Whether the daylight adaptation zone lighting covers both sides in a two-way entrance/exit.
    - Determining the additional material required in equipment for nighttime dimming control.
    - The percentage of commercial buildings in dense urban areas features integrated parking garages (one or more stories of a commercial building are dedicated parking garages).
- Require occupant sensing controls in more spaces
    - Determining the space types that occupancy controls are frequently used (but not currently required by code), and the impact on occupants or call backs.
    - Recent material and labor costs to add occupant sensing controls vs. simple time-switch controls to spaces.

    - Cost of implementing occupied standby controls and cost of integrating lighting and HVAC controls for occupied standby.
    - Information on the practical challenges and issues in programming energy control and management systems (ECMS) for occupied standby.
    - Information on any integration issues between lighting and HVAC controls for implementing occupied standby controls.
    - Information around how occupied standby controls are implemented in practice to meet the current code requirements.
- Reduce occupant sensing control delay time
    - Cost differential between occupancy sensors or control systems that do not provide a time delay setting for 15 minutes or less and those that do provide time delay settings for 15 minutes or less.
    - Cost of occupant sensing technologies that will not result in increased false offs if the time delay is reduced to 15 minutes.
    - Information on any possible prevalent false-offs in specific applications or space types.
    - Information on the fraction of practitioners' existing projects that already use a 15-minute or less time delay for occupant sensing controls.
- Update multilevel lighting controls requirements
    - Data on the fraction of the spaces that are currently exempted from the multilevel lighting controls requirement but will no longer meet the exception after the code change, i.e., spaces in commercial buildings with general lighting power exceeding 50 watts.
    - Cost of implementing manual dimmers for different applications that would be affected, i.e. the cost of implementing multilevel lighting controls in spaces where the general lighting load is greater than 50 watts but lower than or equal to 70 watts.
    - Practitioners' (lighting designers, electrical engineers, installers, commissioning agents, and ATTs) estimates, based on their projects, on the fraction of the spaces that meet the current multilevel lighting control exception but are not exempted from the daylight responsive lighting controls exception.
    - Cost differential between on/off control and dimming control in daylight responsive control implementations.
    - Information on the fraction of practitioners' projects meeting the multilevel lighting control exceptions but not exempted from daylight responsive controls that already have continuous dimming.

    - Determining the additional material required in the equipment and wiring for continuous dimming
    - Any additional cost to enable manual overrides to daylight responsive controls to be timed or reset at the next ON cycle.
    - Information on any technical or programming complexity of enabling manual overrides to daylight responsive controls to be timed or reset at the next ON cycle.
    - Information on the control companies and control solutions that can provide the required control override programming.
    - Information on the current programming of manual override for daylight responsive controls in practice.
- Make the Alternate Partial Daylight Test the only test method for the Daylight Responsive Control Acceptance Test
    - ATTs' estimate of the difference in time and effort between performing the Alternate Partial Daylight Test and performing the original Partial Daylight Test.
    - Determining the factors that currently prevent ATTs from using the Alternative Partial Daylight Test.
- Improve the lighting controls acceptance test methods for luminaire-level lighting controls (LLLC)
    - Information on ATTs' current practice in applying the sampling rules when conducting occupant sensing and daylight responsive controls acceptance tests on LLLC systems.
    - Information on ATT's current practice in conducting the Full Daylight Test on LLLC systems.
    - The differences in time and effort when performing acceptance tests on LLLC systems vs. non-LLLC systems.

Draft Code Language

1.1 Guide to Marked Up Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2025 documents are marked with blue underlining (new language) and ~~strikethroughs~~ (deletions).

1.2 Title 24, Part 1

There are no proposed changes to Title 24, Part 1.

1.3 Title 24, Part 6

SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

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

1. Be readily accessible; and

   Exception to Section 130.1(a)1: Restrooms having two or more stalls, parking areas, stairwells, corridors and spaces of the building intended for access or use by the public may use a manual control not accessible to unauthorized personnel.

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

   Exception to Section 130.1(a)2: In healthcare facilities, for restrooms and bathing rooms intended for a single occupant, the lighting control may be located outside the enclosed area but directly adjacent to the door.

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

4. In Group R occupancies and common or public use areas, where the connected general lighting exceeds 75 watts, controls shall be capable of continuous manual dimming to 10 percent or less of full lighting power in addition to full ON and OFF control. In spaces in nonresidential buildings, where the connected general lighting exceeds 50 watts, controls shall be capable of continuous manual dimming to 10 percent or less of full lighting power in addition to full ON and OFF control.

   Exception 1 to Section 130.1(a)4: Lighting in commercial/industrial shipping and receiving areas, copy rooms, corridors, electrical/mechanical/telephone rooms, kitchen/food preparation areas, laboratories, laundry rooms, locker rooms, manufacturing/commercial/industrial work areas, parking garages, restrooms, stairwells, and transportation concourse/baggage/ticketing areas.

   Exception 2 to Section 130.1(a)4: HID (high intensity discharge) and induction lighting with manual controls that have a minimum of one control step between 30 and 70 percent of full rated power in addition to full ON and full OFF.

   Exception 3 to Section 130.1(a)4: Healthcare Facilities.

Exception to Section 130.1(a): Up to 0.1 watts per square foot of indoor lighting may be continuously illuminated to allow for means of egress illumination consistent with California Building Code Section 1008…

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

~~**Exception 1 to Section 130.1(b):** An indoor space that has only one luminaire.~~

~~**Exception 2 to Section 130.1(b):** Restrooms.~~

~~**Exception 3 to Section 130.1(b):** Healthcare facilities.~~

~~**Exception 4 to Section 130.1(b):** The general lighting with light source of HID and induction shall have a minimum of one control step between 30 and 70 percent of full rated power.~~

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

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

   A. Shall be controlled with an occupant sensing control set to no more than a ~~20~~15-minute time delay, automatic time-switch control, or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and

   …

5. **Occupant sensing controls.** In offices 250 square feet or smaller, multipurpose rooms of less than 1,000 square feet, classrooms of any size, conference rooms, and restrooms, lighting shall be controlled with occupant sensing controls to automatically shut OFF all of the lighting in ~~20~~15 minutes or less after the control zone is unoccupied.

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

   A. Partial-ON occupant sensing controls capable of automatically activating between 50 and 70 percent of controlled lighting power, or

B. Vacancy sensing controls, where all lighting responds to a manual ON input only.

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

~~A. Automatic full-on occupant sensing controls; or~~

~~B. Partial-ON occupant sensing controls, or~~

~~C. Vacancy sensing controls, 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.

Exception 1 to Section 130.1(c)5: Lighting systems not required to comply with the manual dimmer requirement in Section 130.1(a)4 may comply with this section with automatic full-on occupant sensing controls.

6. **Full or partial-OFF occupant sensing controls.** For warehouse aisle ways, warehouse open areas, library book stack aisles, exercise/fitness centers, gymnasium areas, laboratories, lounges, breakrooms, waiting areas, financial transaction areas, computer rooms, main entry lobbies, corridors, stairwells, offices greater than 250 square feet, parking garages, parking areas, loading areas, and unloading areas, the installed lighting meet the following requirements:

   A In warehouse and computer room aisle ways and warehouse and computer room open areas, 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 warehouse and computer room aisle way, and shall not control lighting beyond the aisle way being controlled by the sensor.

   B. In library book stack aisles 10 feet or longer...

   C. In corridors and stairwells,,..

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

      …

      ii. In ~~20~~15 minutes or less after the control zone is unoccupied, the occupant sensing controls shall uniformly reduce lighting power in the control zone to no more than 20 percent of full power. Control functions that switch control

zone lights completely off when the zone is vacant meet this requirement; and

iii. In ~~20~~15 minutes or less after the entire office space is unoccupied, the occupant sensing controls shall automatically turn off lighting in all control zones in the space; and

…

E. In parking garages, parking areas and loading and unloading areas, general lighting shall be controlled by occupant sensing controls that meet the requirements below instead of complying with Section 130.1(c)1:

…

Interior areas of parking garages are under the classification of indoor lighting and shall comply with Section 130.1(c)6E. Parking areas on the roof of a parking structure are under the classification of outdoor hardscape and shall comply with Section 130.2.

EXCEPTION to Section 130.1(c)6E: Luminaires located in a parking garage daylight adaptation zone and dedicated to providing illuminance for daylight adaptation.

F. In laboratory spaces, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power to between 50 percent and 20 percent of full power when the space is unoccupied during normally occupied hours and shall turn off lighting when the space is unoccupied during normally unoccupied hours. Where the lighting system occupant sensors are providing the occupancy status of the laboratory space for ventilation control in accordance with Section 140.9(c)1, the ventilation signal shall be independent of daylighting, manual lighting overrides or manual control of lighting.

…

(d) **Daylight Responsive Controls.**

…

2. All daylight responsive controls shall meet the following requirements:

…

C. The daylight responsive controls shall control general lighting as follows ~~meet the following~~:

i. For spaces in Residential Group R occupancies, including accessory

occupancies, where the installation of multilevel lighting controls is required under Section 130.1(b), allow the multilevel lighting controls to adjust the light level with continuous dimming. For nonresidential buildings, in response to availability of daylight in the space, the daylighting control shall dim the lighting system continuously between 100 percent to 10 percent or lower of lighting power;

…

Exception to 130.1(d)2Ci: Where general lighting is provided by HID or induction light sources, a control shall be permitted that has a minimum of one control step between 30 and 70 percent of full rated power in addition to OFF.

F. ~~The automatic daylighting control shall permit the multilevel lighting control to adjust the level of lighting.~~In spaces where manual controls are required, the manual controls shall be capable of turning off or decreasing light levels below the light level set by the daylight responsive controls. When manual controls are capable of temporarily increasing electric lighting above the light level set by the daylight responsive controls, the controls shall be configured to reset electric lighting controls back to the Section 130.1(d)2C defaults after electric lighting have been turned off or reduced by a manual control, occupancy sensor or timeclock.

…

(g) **Parking Garage Daylight Adaptation Zone Lighting Controls.** Parking garage daylight adaptation zone lighting shall be separately controlled to automatically reduce the lighting to no more than LPD for general light in parking zone and ramps from sunset to sunrise.

EXCEPTION to Section 130.1(g): Group R occupancies and common or public use areas.

1.4 Reference Appendices

NA7.6 Indoor Lighting Controls Acceptance Tests

***NA7.6.1* Daylight Responsive Controls Acceptance Tests**

…

***NA7.6.1.4* Continuous Dimming Control Systems Functional Testing**

Continuous dimming control systems provide more than 10 levels of controlled light output per zone.

…

~~(d) **Partial Daylight Test**. Simulate or provide daylight conditions where illuminance provided only by daylight only at the Reference Location is between 60 and 95 percent of Reference Illuminance measured during the No Daylight Test. Verify and document the following:~~

~~1. Measure that the combined daylight and controlled electric lighting illuminance at the Reference Location is no less than the reference illuminance measured at this location during the No Daylight Test.~~

~~2. Verify that the combined daylight and controlled electric lighting illuminance at the Reference Location is no greater than 150 percent of the reference illuminance.~~

~~3. Light output is stable with no visible flicker. (Note: only luminaires in daylit zones are affected by daylight control)~~

~~(e)~~(d) ~~**Alternate**~~ **Partial Daylight Test**. When outdoor horizontal illuminance is at least 4,000 fc and where illuminance from daylight only at the Reference Location (Partial Daylight Illuminance) is no greater than 80 percent of Reference Illuminance measured at this location during the No Daylight Test. Measure the outdoor horizontal illuminance level and the daylight illuminance level, and do not proceed until the illuminance criteria are met.

Verify and document the following:

1. Measure the Partial Daylight Illuminance at the Reference Location. This can be measured by turning the electric lighting off. (Turn the electric lighting back on before proceeding to next step.)
2. Measure the combined daylight and controlled electric lighting at the Reference Location.
3. This alternate partial daylight test is passed if the measured illuminance value (from Step 2) is no less than the Reference Illuminance measured at this location during the no daylight test and no greater than Partial Daylight Combined Illuminance Maximum (PDCIM).

   In other words, the measured value must be within the following range in order to pass this test.

   Reference Illuminance (from the no daylight test) ≤ measured illuminance value (from Step 2) ≤ PDCIM, where PDCIM = Reference Illuminance (from the no daylight test) + 0.40 x Daylight Illuminance (from Step 1)

4. Light output is stable with no visible flicker.

5. Only luminaires in daylit zones are affected by daylight control.

NA7.6.1.5 ~~Stepped Switching or~~ Stepped Dimming Control Systems Functional Testing

Stepped ~~switching or stepped~~ dimming control systems provide no more than 10 discrete steps of control of light output.

…

(d) **Partial daylight test**. If the control system has one (1) to three (3) steps of control between on and off, test all control steps between on and off. If the control system has more than three (3) steps between on and off, testing three (3) control steps between on and off is sufficient to demonstrate compliance. ~~If the control system has zero (0) steps between on and off, the partial daylight test is not necessary. For stepped switching control systems, steps in a controlled zone are achieved by turning some luminaires or groups of luminaires on or off without any steps between on and off.~~

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. Measure that the combined daylight and controlled electric lighting illuminance at the Reference Location is no less than the reference illuminance measured at this location during the No Daylight Test.
2. Verify that the combined daylight and controlled electric lighting illuminance at the Reference Location is no greater than 150 percent of the reference illuminance.
3. Light output is stable with no visible flicker. (Note: only luminaires in daylit zones are affected by daylight control)
4. The control stage shall not cycle on and off or cycle between dim and undimmed while daylight illuminance remains constant.