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RECOMMENDATION TO SIMPLIFY DAYLIGHT RESPONSIVE CONTROL ACCEPTANCE TESTING

July 17, 2026

California Energy Commission

Docket No. 25-BSTD-03

The California Statewide Codes and Standards Enhancement (CASE) initiative presents recommendations to support the California Energy Commission's (CEC's) efforts to update California's Energy Code (Title 24, Part 6), including revisions to simplify and clarify existing code requirements. Three California Investor-Owned Utilities (IOUs) — Pacific Gas & Electric Company, San Diego Gas & Electric, and Southern California Edison sponsored this effort.

This letter recommends adjustments to the code language for daylight responsive control acceptance testing (NA7.6.1.4) to address stakeholder concerns, improve consistency in interpretation, and support strong compliance. This letter supports a proposed Energy Code change developed in collaboration with stakeholders and informed by field experience¹ and targeted outreach. The proposed changes are intended to improve clarity, consistency, and enforceability without increasing stringency or expanding applicability. As such, a cost-effectiveness analysis is not required.

Outreach for this letter and the separate letter proposing updates to LLLC and associated acceptance testing was conducted in coordination. However, the two letters were developed independently. If both proposals move forward, the proposed language in both letters should be reviewed and revised as needed to maintain consistency between the two efforts.

¹ Code Readiness. *Networked Lighting Controls Advanced Capabilities Evaluation: Office building in Martinez, CA | ETCC*. (November 2023). <https://www.etc-ca.com/reports/networked-lighting-controls-advanced-capabilities-evaluation-office-building-martinez-ca>

1. Measure Description and Justification

1.1 Proposal Description

This proposal recommends revising **NA7.6.1.4 – Continuous Dimming Control Systems Functional Testing** by replacing the existing Partial Daylight Test and Alternate Partial Daylight Test with a single consolidated procedure. The revised procedure maintains existing daylight responsive control performance expectations while simplifying field implementation and improving consistency in acceptance testing.

The acceptance range of the proposed test aligns with that developed for the Alternate Partial Daylight Test and is based on the performance of an LED-based system capable of continuous dimming to 10 percent of full power. The proposed tolerances remain unchanged except for the minimum dimming range. The system must be configured to avoid over-dimming, such that the combined indoor daylight and electric lighting illuminance at the reference location is no less than the reference illuminance measured under no-daylight conditions (e.g., at night). The system must also avoid under-dimming, such that the combined daylight and electric lighting illuminance does not exceed a linear dimming trajectory corresponding to 10 percent light output when daylight illuminance reaches 150 percent of the reference illuminance. Figure 1 illustrates the performance characteristics of a compliant control under the proposed Partial Daylight Test.

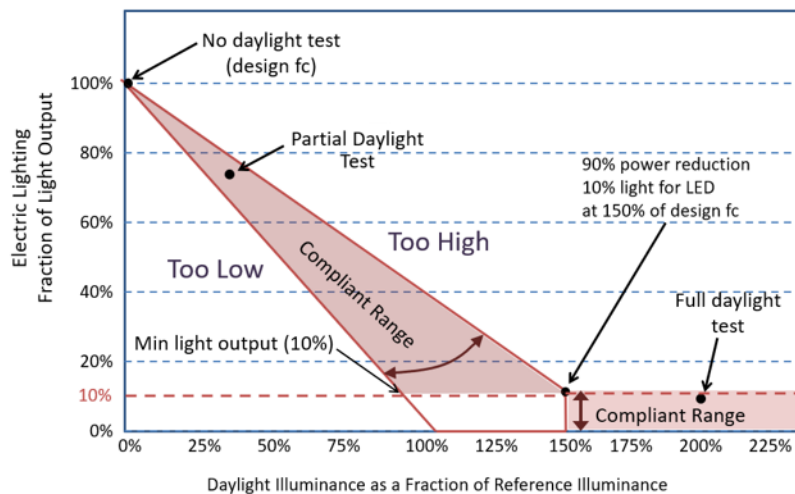


Figure 1. Compliant Range of Daylight Dimming Fraction with Respect to Ratio of Partial Daylight Illuminance to Reference Illuminance

The primary changes proposed to the Partial Daylight Test are as follows:

- **Daylight conditions are not simulated during the Partial Daylight Test.** The revised procedure requires testing under naturally occurring daylight conditions

and evaluates how the lighting control system responds to a combination of electric lighting and daylight. Although daylight conditions can change rapidly, the lights-on and lights-off measurements can be taken within a minute of each other. As a result, under most conditions, the daylight contribution is effectively identical in both measurements. Using electric light to simulate partial daylight does not preserve the relative contributions of daylight and electric light sensed by the control photosensor. Accordingly, the revised procedure eliminates simulated daylight conditions from the test method. (Note that the ‘flashlight test’ is still acceptable for the Full Daylight Test because it is a basic functional check confirming that the system responds as intended.)

- **When the ratio of Partial Daylight Illuminance to Reference Illuminance at the Reference Location is between 60 and 85 percent, the test may be conducted without further adjustment.** This daylight range typically triggers daylight responsive controls across a substantial portion of the electric lighting dimming range, from approximately mid-range to near minimum output. Small measurement errors within this range are unlikely to materially affect the determination of whether the control is properly aligned.
- **If the ratio of Partial Daylight Illuminance to Reference Illuminance at the Reference Location is greater than 85 percent, the conditions are not suitable for confirming proper control operation.** The controlled electric light may already be at minimum output, preventing the test from detecting over-dimming as the control could be fully dimmed with less daylight, and this test would not be able to effectively detect any operational problem. Excess indoor daylight can be reduced by closing blinds or adding obstructions to daylight openings. Alternatively, the test may be conducted later in the day. These adjustments can reduce daylight without materially changing the relative distribution of daylight and electric light sensed by the photosensor.
- **At a ratio of 60 percent, the range of acceptable combined illuminance from electric lighting and daylight is between 100 and 125 percent of the Reference Illuminance value.** The allowable range becomes even narrower as the ratio decreases (see **Error! Reference source not found.**). Because this is a relatively small illuminance difference to measure, even a small measurement error at low daylight levels can correspond to larger deviations under brighter conditions. However, some applications receive very little daylight at the Reference Location because of low-visible-transmittance glazing, limited glazing area, exterior obstructions, or similar conditions. The effect is particularly pronounced in secondary sidelit zones. In these spaces, the test can still confirm that the controlled lighting operates within the correct dimming range when

Partial Daylight Illuminance is less than 60 percent of Reference Illuminance, provided that outdoor total horizontal daylight illuminance exceeds 4,000 foot-candles and the fenestration system is set to its maximum visible transmittance—for example, with blinds or shades fully retracted and dynamic glazing at its highest-transmittance setting. Under these conditions, the Partial Daylight Test is conducted under daylight conditions reasonably representative of those the space experiences over the course of a year.

The proposed change applies to nonresidential indoor lighting systems with daylight responsive controls subject to acceptance testing and does not alter the underlying control requirements, measurement methods, or applicability. The proposal affects acceptance testing criteria only and applies to new construction, additions, and alterations where acceptance testing is required.

1.2 Benefits of Proposed Change

This proposal improves compliance, clarity, and enforceability of daylight responsive control acceptance testing by replacing a method that is difficult to implement for low-transmittance fenestration systems with a more feasible and representative alternative.

Improved Compliance & Consistency

The proposal improves consistency and repeatability in daylight responsive control acceptance testing by consolidating two testing procedures into a single, clearer compliance pathway. The revised procedure is intended to improve interpretation and application across projects while maintaining existing daylight responsive control performance expectations.

Reduced Code Complexity & Ambiguity

Maintaining two parallel test methods creates ambiguity regarding which method should be used and how each should be applied. Reducing the test to one simplifies the procedure and improves clarity for Acceptance Test Technicians (ATTs), enforcement agencies, and project teams.

Reduced Compliance Burden

The proposed change is expected to reduce compliance burden by eliminating a narrow daylight illuminance condition that sometimes requires artificial simulation, repeat testing, or field workarounds. The proposed method may still require careful implementation where outdoor illuminance varies by location, floor level, orientation, season, or sky condition.

1.3 Background Information

Current Daylight Control Requirements

The current daylighting control requirements in Section 601.2.2.4.3 [Section 130.1(d)2C] require that “the combined illuminance from the controlled lighting and daylight is not less than the illuminance from controlled lighting when no daylight is available,” and that “when the daylight illuminance is greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power in that daylight zone shall be reduced by a minimum of 90 percent.” These requirements are reflected in the equation that defines the upper bound of the acceptable illuminance range. Partial Daylight Combined Illuminance Maximum (PDCIM) is based on a linear interpolation of the combined illuminance from electric lighting and daylight at the Reference Location, from 100 percent of Reference Illuminance when no daylight is present to 160 percent of Reference Illuminance when daylight illuminance at the Reference Location equals 150 percent of Reference Illuminance. At that point, the 160 percent combined illuminance consists of 150 percent daylight and 10 percent electric lighting. Figure 2 presents PDCIM graphically as a function of daylight illuminance normalized to Reference Illuminance.

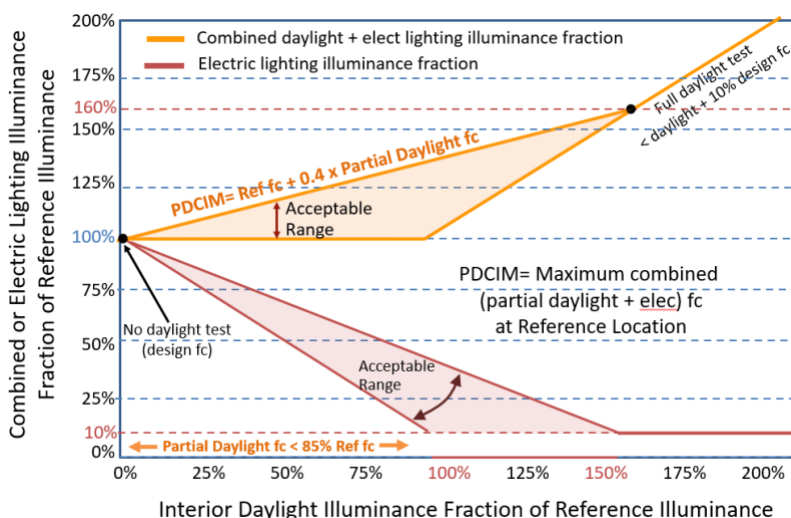


Figure 2: Compliant Range of Combined Electric Lighting and Daylight (Total Illuminance) as a Fraction of the Reference Illuminance (in Orange)

Current Partial Daylight Test Requirements

The current Partial Daylight Test requires daylight illuminance at a reference location to fall within a narrow range of 60 percent to 95 percent of the electric lighting reference illuminance. Due to variability in weather conditions, solar position, glazing properties,

building orientation, and exterior obstructions, these conditions are often difficult to achieve and maintain during field testing.

The greatest challenges typically occur in spaces with low visible transmittance glazing, secondary sidelit zones, exterior shading conditions, or limited daylight penetration. These conditions can make it difficult to achieve the required illuminance range despite otherwise functional daylight responsive controls.

The current Energy Code allows technicians to “simulate or provide daylight conditions,” which has led to the use of artificial lighting and other workarounds in the field. These simulated conditions may not accurately represent the relationship between daylight availability and control system response. The revised test procedure better characterizes control system performance under naturally occurring daylight conditions representative of typical building operation throughout the year.

Hour	Total Horizontal Illuminance on Winter Solstice (fc)	Total Horizontal Illuminance on Fall and Spring Equinox (fc)	Total Horizontal Illuminance on Summer Solstice (fc)
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	372
7	0	1,040	1,784
8	644	3,093	3,840
9	2,066	5,118	5,889
10	3,430	6,762	7,696
11	4,348	7,869	9,113
12	4,699	8,353	10,036
13	4,447	8,178	10,400
14	3,618	7,357	10,181
15	2,313	5,953	9,393
16	841	4,082	8,091
17	0	1,968	6,370
18	0	362	4,365
19	0	0	2,278
20	0	0	589
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0

Note: Hours where the total horizontal illuminance is over the proposed threshold criteria of 4,000 total horizontal foot-candles are highlighted in yellow.

Figure 3: Gillette Clear Sky Model²; Total Horizontal Illuminance by Hour of Day for Winter and Summer Solstice and Spring and Fall Equinox

The Alternate Partial Daylight Test, introduced in the 2022 Energy Code, evaluates system performance under naturally occurring bright daylight conditions ($\geq 4,000$ fc outdoor horizontal illuminance). This approach reduces reliance on artificial simulation

² Gillette G., Pierpoint W., & Treado S. 1984. "A general illuminance model for daylight availability." Journal of the Illuminating Engineering Society. 13(4), 330-340.

and better reflects actual system operation.³ Figure 3 illustrates that 4,000 foot-candle outdoor total horizontal daylight illuminance conditions occur throughout the year during clear sky conditions.

2. Stakeholder Engagement to Inform Proposal

When developing this proposal, the Statewide CASE Team engaged with stakeholders including Acceptance Test Technicians (ATTs) and lighting controls experts involved in the Energy Code compliance process.

This proposal originated from field experience and stakeholder observations regarding implementation challenges associated with the current Partial Daylight Test procedure. To further evaluate these challenges, the team developed and distributed a targeted survey to ATTs to collect structured feedback on feasibility, time burden, and test method preference. Interviews were conducted with respondents who indicated availability and interest in discussing the topic further.

Survey responses from 73 Acceptance Test Technicians in April 2026 quantified field experience with both test methods. Results showed the following key findings:

- Approximately **63 percent** of respondents reported difficulty achieving the required 60–95 percent daylight illuminance range sometimes (32 respondents), frequently (9 respondents), or very frequently (4 respondents)
- Approximately **58 percent** reported using artificial lighting or other methods to simulate daylight conditions occasionally (23 respondents) or frequently (19 respondents)
- Among the 36 respondents with experience using both methods, **47 percent** (17 respondents) reported that the Partial Daylight Test required more time than the Alternate Partial Daylight Test, **31 percent** (11 respondents) reported about the same time, and **22 percent** (8 respondents) reported less time.

In follow up interviews with four respondents, ATTs reported challenges performing the current Partial Daylight Test under common field conditions, particularly in spaces with no blinds or shades, heavily tinted or unusual glazing, skylit zones, high ceilings, small

³ For more detail on the background of alternate partial daylight acceptance test, see https://title24stakeholders.com/wp-content/uploads/2020/09/NR-Daylighting_Final-CASE-Report_Statewide-CASE-Team.pdf

retail spaces, grocery stores, restaurants, and other commercial spaces with limited daylight control.

In general, the survey and interview feedback summarized above support simplifying the daylight responsive control acceptance test by consolidating the existing procedures into a single clearer test methodology. However, respondents emphasized that successful implementation of the revised procedure will require clear documentation, examples, and training guidance. Recommended areas for clarification include outdoor illuminance measurement, multistory buildings, highly variable daylight conditions, and situations where compliant daylight conditions are difficult to achieve despite reasonable field effort.

3. Proposed Code Language

3.1 Guide to Markup Language

The proposed changes to the standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2025 documents are marked with dark blue underlining (new language) and ~~striketroughs~~ (deletions).

3.1.1 Energy Code (Title 24, Part 6)

3.1.1.1 Reference Appendices

APPENDIX JA1 – Definitions

REFERENCE LOCATION is the fixed point within the applicable daylit zone and within the area illuminated by the controlled luminaires being tested at which all required indoor illuminance measurements for the No Daylight, Full Daylight, and Partial Daylight Tests are taken.

REFERENCE ILLUMINANCE is the illuminance measured at the Reference Location during the No Daylight Test, produced solely by the controlled electric lighting operating at full design output, full programmed output, or a documented intentionally tuned output, with no contribution from daylight.

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.

(a) Reference Location. Identify the minimum daylight location in the controlled zone (Reference Location) for each daylit zone type (skylit, primary sidelit, and secondary sidelit) in the space. This can be identified using either the illuminance method or the distance method and will be used for illuminance measurements in

subsequent tests. For parking garages, the reference location should always be the farthest edge of the secondary sidelit daylit zone away from the opening or glazing.

Illuminance Method

The Reference Location is the task location with [the](#) lowest daylight illuminance in the zone illuminated by controlled luminaires.

Turn off controlled lighting and measure daylight illuminance within zones illuminated by controlled luminaires. (Note: turn the controlled lighting back on before proceeding to the No Daylight Test)

Distance Method

The Reference Location is the task location within the zone illuminated by controlled luminaires that is farthest away from daylight sources.

(b) No Daylight Test. Simulate or provide conditions without daylight. Verify and document the following:

1. Document the ~~reference illuminance~~ [Reference Illuminance](#) at the Reference Location, which is the electric lighting illuminance level at the Reference Location.
2. Daylight responsive control system turns on all controlled lighting to full light output (full design output, or full programmed output) unless it has been documented, such as in design documents, that continuous dimming luminaires have been intentionally tuned to less than full light output.
3. Light output is stable with no visible flicker.

(c) Full Daylight Test. Simulate or provide bright conditions where the daylight illuminance is greater than 150 percent of the ~~reference illuminance~~ [Reference Illuminance](#) (measured during the No Daylight Test). Alternatively, provide simulated bright conditions by shining a bright light into the daylight sensor. Verify and document the following:

1. The controlled lighting power reduction is at least 90 percent under fully dimmed conditions for non-parking garage locations. For parking garages, the controlled lighting power reduction is 100 percent under fully dimmed conditions.
2. Only luminaires in daylit zones are affected by daylight control. If the daylighting control system controls luminaires outside of the daylight zones including those behind obstructions, the control system is not compliant.
3. If a Power Adjustment Factor (PAF) is claimed for daylight continuous dimming plus off controls in accordance with Section 140.6(a)2H; a compliant system shall automatically turn off the luminaires in order to pass the Full Daylight Test for daylight continuous dimming plus off controls. This portion of the Full Daylight Test does not apply to lighting systems that are not claiming a PAF for daylight continuous dimming plus off controls.

(d) Partial Daylight Test. This test shall be conducted during daylight hours where the ratio of Partial Test Daylight Illuminance to the Reference Illuminance from the No Daylight Test is between 60 and 85 percent. If the ratio is above 85 percent, add obstructions to the passage of daylight or conduct the test when outdoor horizontal illuminance is reduced so that the ratio of Partial Test Daylight Illuminance to the Reference Illuminance from the No Daylight Test is between 60 and 85 percent. If the ratio is less than 60 percent, even after increasing the transmittance of the fenestration system, conduct the test when the outdoor unobstructed ambient illuminance is no less than 4,000 footcandles (fc).

1. Partial Test Daylight Illuminance is Measured at the Reference Location with all electric lights turned off (footcandles).
2. Adjust blinds, adjust *dynamic glazing* transmittance and, if needed, install other obstructions to transmittance of daylight through fenestration until the Partial Test Daylight Illuminance is between 60 percent and 85 percent of the Reference Illuminance.

If Partial Test Daylight Illuminance is greater than 85 percent of Reference Illuminance, after reducing transmission of daylight, conduct test when ambient illuminance has dropped sufficiently so that Partial Test Daylight Illuminance is between 60 percent and 85 percent of the Reference Illuminance.

Record Partial Test Daylight Illuminance (footcandles)

Calculate Ratio of Partial Test Daylight Illuminance to Reference Illuminance.

If Ratio of Partial Test Daylight Illuminance to Reference Illuminance is between 60 percent and 85 percent, skip to step 4.

3. Conducting the partial daylight test when the ratio of Partial Test Daylight Illuminance to the Reference Illuminance is less than 60 percent shall be allowed, if the outdoor horizontal illuminance is no less than 4,000 footcandles (fc) and fenestration system transmittance is maximized, including retracting blinds and adjusting *dynamic glazing* transmittance to its maximum value.

Record Outdoor Horizontal Illuminance (fc)

Record Partial Test Daylight Illuminance (fc)

Calculate Ratio of Partial Test Daylight Illuminance to Reference Illuminance (percent)

4. Turn electric lighting on. Wait until control has stabilized.

Record the measured Partial Test Combined Illuminance of daylight and electric lighting illuminance at the Reference Location.

Record test failure if lighting source is unable to stabilize or is visibly flickering.

5. Control PASSES Partial Daylight Test if all of the following are TRUE:

A. Partial Test Combined Illuminance (fc) is no less than the Reference Illuminance (fc).

B. Partial Test Combined Illuminance (fc) is no greater than the Partial Daylight Combined Illuminance Maximum, PDCIM (fc).

Where,

$$\text{PDCIM} = \text{Reference Illuminance} + 0.40 \times \text{Partial Test Daylight Illuminance}$$

C. The light source is stable with no visible flicker.

~~**(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) 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) $\leq$ measured illuminance value (from Step 2) $\leq$ 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.~~