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Submitted via email: [docket@energy.ca.gov](mailto:docket@energy.ca.gov)

Mr. Andrew McAllister  
Commissioner  
California Energy Commission  
1516 Ninth Street  
Sacramento, California 95814

**Proposed Revisions to the California Building Energy Efficiency Standards California Code of Regulations, Title 24, Part 6 and Appendices; 45-Day Language**

Dear Commissioner McAllister,

The National Electrical Manufacturers Association (NEMA) appreciates the opportunity to provide the attached comments on the California Energy Commission's Proposed Revisions to the California Building Energy Efficiency Standards California Code of Regulations, Title 24. These comments are submitted on behalf of NEMA Lighting Systems Division companies.

The National Electrical Manufacturers Association (NEMA) represents nearly 400 electrical and medical imaging manufacturers. Our combined industries account for more than 400,000 American jobs and more than 7,000 facilities across the U.S. Domestic production exceeds \$117 billion per year.

Please find our detailed comments below. We look forward to working with you further on this important project. If you have any questions on these comments, please contact Alex Boesenberg of NEMA at 703-841-3268 or [alex.boesenberg@nema.org](mailto:alex.boesenberg@nema.org).

Sincerely,



Kyle Pitsor  
Vice President, Government Relations

## **NEMA Comments on Proposed Revisions to the California Building Energy Efficiency Standards California Code of Regulations, Title 24**

### **General Comments:**

Since the beginning of the proposal development process for this code cycle, NEMA has been collaboratively working with CEC staff and contractors on these proposals. We have submitted detailed written comments to the CEC in the course of this process, and we have participated in numerous technical meetings with Commission staff.

We share the Commission's interest in and goals for energy-efficiency improvements in building and appliance regulations. Industry strives to provide capable, efficient, affordable products to the California market along with associated installation and operational considerations for their effective use in the State. We are disappointed that many significant, substantive comments and recommendations that NEMA has submitted in this code cycle appear to have been ignored and are not reflected in the Commission's 45-day language. We appreciate the pledge made by CEC staff during the March 2<sup>nd</sup> webinar that the CEC will address our previous comments.<sup>1</sup> Accordingly, we are restating many of our prior comments and recommendations here with the expectation they will be considered and addressed by the Commission in accordance with California Government Code §11346.9(3).

It is not the electrical industry's intent to discourage the Commission from promoting and advancing energy efficiency in buildings. That objective is shared by NEMA organizationally and among our members. Rather it is our duty to point out flaws in assumptions regarding technical feasibility resident in the CASE and CEC Staff work. We are concerned that the apparent dismissal of our previously expressed concerns warrants careful reconsideration of the 45-day language.

We are concerned that the Commission staff has become over-reliant on CASE studies and opinions, and that sufficient rigor has not been applied to the studies or opinions. For example: we have commented previously that the data provided from equipment studied for the proposed Joint Appendix 10 was not statistically significant in its amount or adequate in scope for the technologies involved<sup>2</sup>. We ask the Commissioner to take note of this. We urge the Commission to increase the rigor and mandatory feasibility/representation requirements placed on CASE study reports and studies and are preparing a letter of recommendations for this. We also point out that an opinion piece<sup>3</sup> has been inserted into the record very recently by CEC staff that contains no data or analysis to back up the opinions expressed, and it would be a

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<sup>1</sup> On a telephone call of March 11<sup>th</sup> CEC staff member Mr. Maziar Shirakh stated this response will be delivered by the end of March 2015, which is the same time the 45-day comment period closes and two weeks after the verbally stated deadline to affect 15-day language (March 17<sup>th</sup>, as stated in Staff's opening remarks of the March 2<sup>nd</sup> webinar).

<sup>2</sup> The CASE team studies were discussed at the September 29, 2014 staff workshop and at this meeting the IOU team admitted to only testing 4 lamps [http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29\\_workshop/2014-09-29\\_aaer\\_transcript.pdf](http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29_workshop/2014-09-29_aaer_transcript.pdf) NEMA commented on this inadequacy in writing to the commission [http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29\\_workshop/comments/NEMA\\_Cooments\\_on\\_Staff\\_Analysis\\_of\\_Small\\_Diameter\\_Directional\\_Lamp\\_and\\_LightE\\_mitting\\_Diode\\_Lamp\\_Efficiency\\_Opportunities\\_2014-11-14\\_TN-740012.pdf](http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29_workshop/comments/NEMA_Cooments_on_Staff_Analysis_of_Small_Diameter_Directional_Lamp_and_LightE_mitting_Diode_Lamp_Efficiency_Opportunities_2014-11-14_TN-740012.pdf)

<sup>3</sup> Leukos - The Journal of the Illuminating Engineering Society of North America – "High Color Rendering Can Enable Better Vision without Requiring More Power."

mistake to rely on opinion pieces that are not supported by data and analysis in making public policy.

For the purposes of clarifying our concerns, we restate previous industry comments followed by new comments to the 45-day language previously not covered.

### **Review of Comments Not Yet Satisfied**

The following items reiterate our previous comments submitted July 25, 2014<sup>4</sup>:

1. The proposed multiple quality attributes will drive up the cost of the products due to high cost of components, financial implications with warranties and administration, additional labeling and additional testing. The cost projections on slides 10, 28, 29 and 30 were not based on the consideration of the proposed code revisions. Therefore the cost projections in the CASE proposal are not accurate since they don't represent products that meet all the overlapping quality attributes. There were comments at the June [2014] workshop suggesting that builders should be required to provide the lighting facts information (brightness, watts, color) and cost to the homeowner allowing them to understand the tradeoffs and make a decision about their preferences. The cost analysis provided in the Financial Impact Statement<sup>5</sup> of February 27, 2014 does not satisfactorily address this concern. We go into further detail in our new comments below. (See comments #2, 6 and 8 on pages 8, 12 and 13, respectively..
2. Joint Appendix 8: due to the numerous changes to JA8 we will respond to it anew below rather than restate previous comments.
3. 150.0(k)2J and 150.0(k)2K. The 2016 Title 24 should require all luminaires in these non-living spaces to be on an energy-saving control, not just one luminaire in those spaces. If anything, it should be written the other way around so that only one luminaire can be uncontrolled. Also, a partial-ON occupant sensor should be allowed as they have been shown to save even more energy than vacancy sensors because occupants are usually satisfied with 50% of the lighting on and they don't need 100% of the lighting on<sup>1</sup>. This is a step backward from the current standard.

Proposed changes:

150.0(k)2 J. In Bathrooms, attached and detached Garages, Laundry Rooms, and Utility Rooms, ~~at least one~~ all luminaires in each of these spaces shall be controlled by a, vacancy sensor or partial-on occupant sensor (with the exception of nightlights or security lights).

150.0(k)2 K. All screw based fixtures shall be controlled by a dimmer, ~~or~~ vacancy sensor, or partial-on occupant sensor.

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[http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/prerulemaking\\_comments/NEMA\\_Comments\\_on\\_Staff\\_Workshop\\_on\\_Proposed\\_Lighting\\_Efficiency\\_Measures\\_for\\_Residential\\_and\\_Nonresidential\\_Buildings\\_2014-07-25\\_TN-73481.pdf](http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/prerulemaking_comments/NEMA_Comments_on_Staff_Workshop_on_Proposed_Lighting_Efficiency_Measures_for_Residential_and_Nonresidential_Buildings_2014-07-25_TN-73481.pdf)

<sup>5</sup> [http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/EFIS\\_2016\\_title24\\_parts\\_01\\_06/](http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/EFIS_2016_title24_parts_01_06/)

4. 150.0(k)9 Residential Outdoor Lighting. Landscape lighting is still not addressed. All exterior lighting should be controlled, not just the exterior lighting that is attached to a building.

Proposed changes:

150(k)9A. For single-family residential buildings, landscape lighting and outdoor lighting permanently mounted to a residential building or other buildings on the same lot meet all of the following requirements in item (i) and the requirements in either item (ii) or item (iii):

5. CEC Proposal: Add provisions to Section 130.1(c)5 whereby a Partial-On Occupant Sensor would have the automatic on level set between 50-70 percent of full rated power.

NEMA Comment: We disagree with the proposal to set a minimum automatic on level to 50%. This limits the amount of energy savings possible with today's control technologies. We propose to only set a maximum limit for the partial-on function, or, if a minimum is deemed necessary, then we propose to change this minimum limit to 10%. (We refer to the September 27, 2013 PG&E report for the Ace Hardware LED High-Bay Lighting and Controls Project, by Mutmanský and Berkland, which demonstrates the savings possible with occupancy sensors.)

NEMA Recommendation: Change the language to Read "Partial-On Occupant Sensor would have the automatic-on level set to no more than 70% of full rated power, OR, Partial-On Occupant Sensor would have the automatic-on level set to between 10 and 70%"

6. Add provisions for "intelligent luminaire" functionality in open offices

Proposal: Add an exception in 130.1(a) area control for open office applications when partial-on luminaires are used with controls embedded in each luminaire.

Rationale: These systems provide embedded occupancy and daylight control in each luminaire. Upon occupancy, lights turn on to a background level which is at 20% power, then once occupancy is stable, lights increase to a higher "task" level for providing task illuminance at the desk. The task level for open offices is preset at approximately 90% of full power. These granularly controlled systems save more energy than "auto-on to 50%" systems because they turn lighting on to 10% power, and operate at an individual luminaire level, rather than grouped control. In these cases, a manual-on switch is not needed, nor is manual-off because lights turn off when the area is vacant below the luminaire, and automatically turn on to background level upon occupancy.

NEMA Recommendation: Add a second exception to read as follows:

Proposed

EXCEPTION to Section 130.1(a)1: In open offices, luminaires using embedded occupancy and daylight sensors in each luminaire, together with continuous dimming drivers/ballasts, that operate in a manner where each luminaire has:

- 1) Integral occupancy sensors that automatically turn on to no more than 30% power upon initial occupancy, turn to a higher level when fully occupied, and automatically turn off when unoccupied, and
- 2) Integral daylight sensors that automatically calibrate at each activation, and need not be controlled using manual-on and off lighting controls.

7. Table 140.7A – The percent changes in LPA are not consistent and are much more restrictive for higher zones. In the June workshop, homebuilders referenced the inherent inefficiencies with 250 watt Metal Halide systems; however the changes seem to be overly aggressive for higher zones. We appreciate the projections that LED systems will be 30% more efficient by 2017, but the energy standards must be based on an analysis of commonly available existing technologies today. This variation in reduction to LPA by zone should be specifically addressed for the next workshop and the models should be made available for public review.

The following items below are reiterated previous comments submitted November 24, 2014<sup>6</sup>:

1. Consumer Preference and Lack of Feasibility Analysis: The current residential lighting proposals assert that superior performance in each attribute is required for every application in a residence. The proposals have not provided the substantiation with regard to consumer preference for specific threshold levels of performance and may not be technically justified. There is no consideration in the proposals to account for different consumer needs with respect to the applications such as kitchens, bathrooms, garages, and outdoor lighting. Furthermore, no economic justification has been provided for the cost analysis of systems that require the combination of all of the performance attributes.
2. “Technology Neutral” Should Be Truly Neutral: The proposed Joint Appendix 8 requirements add significant restrictions to product availability and are applied inconsistently by technology. The requirements applied to recessed luminaires are not technically substantiated. Many of the requirements appear to relate to LED test methods for light sources or lamps, but are included in the appendix with the intent to apply to residential luminaires. As we note in a preceding comment, certain proposed requirements are based on assumptions about consumer preference which actually may vary depending on architectural design or finishes. The restrictive prescriptive requirements in JA8 have the potential to revert the marketplace to lighting of lower quality and efficiency as a result of the costs associated with the testing and performance requirements in JA8. In general, Appendix JA8 needs substantial work to clarify the application of test methods and to validate the justification and cost effectiveness of the proposals. NEMA members believe that the list of attributes for performance criteria should be balanced so as to allow adequate choices by consumers rather than fixed to single-choice options via arbitrary and unsubstantiated thresholds.
3. Joint Appendix 10 and Flicker requirements: NEMA reaffirms its opposition to the CEC establishing its own mandatory flicker test procedures ahead of numerous industry working groups examining this phenomenon and working to identify repeatable objective tests to evaluate it. We caution against adopting the proposed test procedure in Joint Appendix 10 because it has not been adequately tested and it is not related to other, more advanced, efforts taking place in the IEEE and other scientific forums. The number of devices tested by the IOU/CASE team is woefully inadequate and the CEC is taking a significant risk by relying on such a small, unrepresentative data set. An IEEE document drafted and tested

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<sup>6</sup> [http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-11-03\\_workshop/comments/NEMA\\_Comments\\_on\\_Process\\_in\\_Application\\_for\\_2016\\_Update\\_2014-11-24\\_TN-74047.pdf](http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-11-03_workshop/comments/NEMA_Comments_on_Process_in_Application_for_2016_Update_2014-11-24_TN-74047.pdf)

by an eminent scientific panel is currently in ballot<sup>7</sup>. We appreciate the comments expressed by the IOU CASE team in which they attempted to downplay the potential confusion inherent in the proposed one-off test procedure. The Flicker Test Procedure in Joint Appendix 10 is not adequately vetted and should not be allowed to proceed into regulation; the draft Appendix should be struck.

The following items below reiterate previous comments submitted December 22, 2014<sup>8</sup>:

1. Section 130.0 - Changes to Luminaire conversion practices

We applaud the intention of the CEC staff to simplify the code and align with other standards such as ASHRAE 90.1. Removing items like: "Luminaire modification in place" is the right step.

We further urge the CEC to remove all declarations such as in 130.0(c)5: "...Field modifications, including hard wiring of an LED module, shall not be recognized as converting an incandescent luminaire or luminaire housing to a non-incandescent technology". We believe it is potentially very confusing to consumers and inspectors to convert a luminaire from one technology to another and yet continue to treat it as if it were the original technology.

2. Section 130.1(b) - Change title "Multi-Level Lighting Controls" to "Multi-Level Lighting Control". To be consistent with new wording in paragraph.
3. Section 130.1(c) Shut-OFF Controls - Change 10 minute timeout values to 20 minutes to align with Section 110.9(b)4F. If an occupancy sensor with a 20 minute timeout can be used in these spaces then a countdown timer with 20 minute setting should be allowed. Ten minutes is too short of a period, and it may cause false offs. We suggest the following change:

EXCEPTION 1 to Section 130.1(c)2: Single-stall bathrooms less than 70 square feet, and closets less than 70 square feet may use countdown timer switches with a maximum setting capability of ten 20 minutes to comply with the automatic shut-Off requirements.

4. Section 130.2(c)3.B. - We support the requirement for control responsive lighting, however we have questioned in the past why there is a limit to the dimming range. Since Title 24 is an application standard, the lighting design must ensure that it meets IES illuminance levels as well as safety and security concerns. There are some areas of an outdoor application where it may be more efficient and more cost effective to reduce the lighting power to zero. This does not imply that all the lights in an area would be off, but selected equipment could be turned off during times when the space is unoccupied and save additional energy. We ask that the Commission explain the justification for the dimming range of 40-90% and consider a dimming range of 40-100%.

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<sup>7</sup> Update: This document has completed ballot and is being readied for publication. We again request the CEC abandon Joint Appendix 10 in favor of this more thoroughly developed and tested document.

<sup>8</sup> [http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-11-03\\_workshop/comments/NEMA\\_Comments\\_RE\\_Notice\\_of\\_Staff\\_Workshop\\_2014-12-22\\_TN-74187.pdf](http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-11-03_workshop/comments/NEMA_Comments_RE_Notice_of_Staff_Workshop_2014-12-22_TN-74187.pdf)

5. Table 140.7-A Changes to Hardscape Lighting Power Allowances NEMA supports updates to the models to use LED technology as the baseline for lighting power allowances in tables 140.7.A and 140.7B.

We direct the CEC's attention to remarks at the June 23, 2014 workshop, where it was stated that the models were based on projections regarding how products would perform by January 2017. This raises serious concerns regarding the standard's compliance the Warren-Alquist Act, which mandates that the standards shall be "technologically feasible and cost-effective." The term "feasible" has been interpreted in California statutes as "practicable – i.e., capable of being done or carried out. It does not mean possible or probable." It is not appropriate to base the power models for outdoor lighting on probable projections about future performance. We recommend that the models be reevaluated using technology that is currently feasible to meet the statutory requirement.<sup>9</sup>

At the June 23, 2014 workshop NEMA and lighting manufacturers indicated a concern with the significant reductions in lighting power density in lighting zones 3 and 4. The November 3 presentation for this section indicated that the power allowances were reduced about 35-40%, however that range is not consistent with the proposed standards language. The reductions in the general hardscape area wattage allowance are as follows: LZ1: 43%, LZ2: 33%, LZ3: 56%; LZ4: 57%. It was explained that the 2005 models used 250w MH technology, which is not as efficient as other MH wattages. However, the 250w products are not generally used in lighting zones 3 and 4 to achieve the higher illuminance requirements. These variations seem to be more aggressive for zones that impact the majority of installations. Consistent with the previous comment, we would like for the models to be reevaluated to ensure that the assumptions are correct and applied consistently to all lighting zones.

6. In addition, the IES has recently issued an update to RP-20 for parking facilities. The updates to the recommended maintained illuminance levels do not impact the power allowances for areas with asphalt surfaces. However they have added new illuminance requirements for concrete surfaces and transactional areas. We recommend that exceptions be added to Tables 140.7-A and 140.7-B to provide a multiplier of 2.0 to accommodate concrete surfaces and transactional areas to be consistent with IES illuminance recommendations.
7. Table 140.7-B Changes to Additional LPAs for Additional Applications NEMA echoes our proceeding comments to Table 140.7A which also apply to Table 140.7B.
8. Numerous recommendations and concerns expressed to Joint Appendix 8 remain unaddressed. Since the draft made several changes though, we will comment separately on this Appendix later in this document rather than restate our previous comments since they may no longer be accurate to the 45-day language changes.
9. Joint Appendix 10: NEMA has commented at length already on the risks and burdens associated with establishing a California-only test procedure in view of emerging global

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<sup>9</sup> Update: NEMA members cannot find evidence in the CASE report being leveraged to justify this proposal that any products today can satisfy this requirement and we ask the CEC to respond to this concern with a contradiction or confirmation of this statement. See our new comment #7 below which relates to this subject.

flicker test procedure developments. As we noted in our written comments<sup>10</sup> the testing performed by the IOU teams was “woefully inadequate” and we stand by this statement. We ask the Commissioner to take note of this.

10. Definitions: Since the CEC undertook several modification to definitions in the staff proposals, NEMA reviewed all definitions in use for lighting products in Title 20 and compared them to definitions already established by the Illuminating Engineering Society (IES) and other accepted industry practices. These were submitted but were not included in the 45-day language. We resubmit them in an appendix to this document.

#### New and Expanded Comments to Proposed Regulatory Language

In response to the 45-day language we submit the following new, or revised, comments:

1. Further investigation into Table 140.7 regarding projected efficiency levels versus actual is warranted. If based on projections of how technology might perform in the future, not existing available technology, it raises concerns on compliance with the requirements of the Warren-Alquist Act.
2. Regarding submission of comments during the 45-day and 15-day language periods. In the opening remarks of the March 2<sup>nd</sup> 45-day language hearing, CEC staff noted that comments intended to affect the 15-day language must be received by March 17<sup>th</sup>. This is in conflict with the publicly stated deadline for comments on the 45-day language of March 30<sup>th</sup>. While NEMA understands the desire of CEC staff to move expeditiously, we are concerned that this is a violation of the California Government Code.

Prescriptive requirements and mandatory justification requirements: NEMA is concerned that some of the prescriptive requirements in this cycle of proposals have not being given adequate review and analysis as required by California Code. We are concerned at the expanding list of non-efficiency-related requirements for components and appliances that CEC has proposed to the building regulations. For example, we note that many non-energy attributes are being added for various lighting products in Joint Appendix 8, and they are not applied uniformly across all technologies. California Government Code §11346.1(b)(1) and §11346.5(a)(7)(c)(iii) signal a policy preference for performance-based standards and they also require mandatory reviews and reports when prescriptive standards are to be proposed<sup>11</sup>. Insufficient detail is provided in the Commission’s Initial Study/Proposed Negative Declaration<sup>12</sup> and related documents in the Rulemaking docket to determine or verify if the 45-day language’s prescriptive proposals have received these required reviews. NEMA requests this informationAppliance- and technology-specific construction and

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<sup>10</sup> The CASE team studies were discussed at the September 29, 2014 staff workshop and at this meeting the IOU team admitted to only testing 4 lamps [http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29\\_workshop/2014-09-29\\_aaer\\_transcript.pdf](http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29_workshop/2014-09-29_aaer_transcript.pdf) NEMA commented on this inadequacy in writing to the commission [http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29\\_workshop/comments/NEMA\\_Cooments\\_on\\_Staff\\_Analysis\\_of\\_Small\\_Diameter\\_Directional\\_Lamp\\_and\\_LightE\\_mitting\\_Diode\\_Lamp\\_Efficiency\\_Opportunities\\_2014-11-14\\_TN-740012.pdf](http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29_workshop/comments/NEMA_Cooments_on_Staff_Analysis_of_Small_Diameter_Directional_Lamp_and_LightE_mitting_Diode_Lamp_Efficiency_Opportunities_2014-11-14_TN-740012.pdf)

<sup>11</sup> We refer the commission to the details of these Sections, which due to their length are not quoted here.

<sup>12</sup> <http://www.energy.ca.gov/2015publications/CEC-400-2015-012/CEC-400-2015-012.pdf>

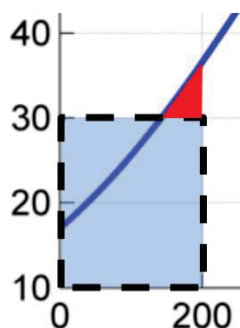
performance requirements not related to energy-efficiency should not be delineated in any Title 24 Appendix.

3. Joint Appendix 8: We continue to oppose over-specified performance parameters and requirements such as CRI >90, R9 > 50, SDCM<4 (or, in the case of JA8,  $|Duv| < 0.0033$ ), CCT limited to <3000K, PF>0.9, minimum dim level <10%, start time < 0.3s (Note: this is given as 0.5s in JA8.4.3), and a 5 year warranty, as minimum requirements in code. The 2016 proposal widens the requirement for these over-specified parameters, both by increasing the number of specifications from 2013, and by its extended reliance on Appendix JA8. Table 150.0-A states that only LED must meet JA8. We do not support the CEC's stance to have different performance specifications for different lighting technologies. None of these parameters should be stricter than ENERGY STAR, for a minimum State specification.

We also question the need for rewriting ENERGY STAR specifications, such as Efficacy (JA8.3.1), Power Factor (JA8.3.2),..., Lumen maintenance (JA8.4.7), or Elevated temperature (JA8.4.8).

JA8's restrictions on flicker, as summarized in Table JA8, are overly restrictive for some frequencies and too lax for others. The human eye definitely does not have a flat response over the range from 0 to 200 Hz.

This specification makes no allowance for the dependence of human flicker sensitivity either on frequency or on wave shape. For sine wave modulation, the visibility threshold for stroboscopic effects, expressed in terms of modulation depth, is shown in the figure below. At a particular frequency, modulation depths above the curve can be detected by most people. Below the curve, they are not detected by most people. The threshold changes for different wave shapes, in a way that depends on the Fourier components of the light output waveform. A full Fourier approach would take account of both frequency and wave shape effects. Sensitivity to flicker also depends on the application. Flicker in outdoor street lighting or in stairwells is more tolerated than in indoor offices, for instance. Therefore, a curve of acceptability may be above the visibility threshold curve. Different curves may be needed for different applications.

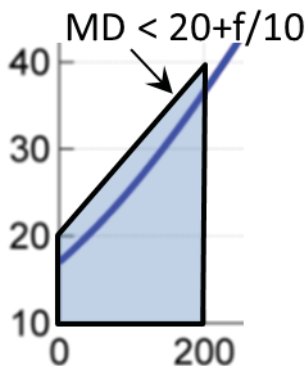


Zooming in on the region from 0 to 200 Hz in the figure above (right), the blue shaded rectangular region with dashed outline represents the conditions allowed by the JA8. The red triangle is forbidden by the JA8, but flicker in this region is not visible to most observers. JA8 as a MINIMUM specification should not exclude acceptable regions where flicker is not even be detected.

Appendix JA8 does a poor job of defining acceptable flicker levels, and the test procedure in appendix JA10 does a poor job of determining flicker acceptability. Specifications on flicker and test procedures should wait until the experts (in IEEE and in IEC) conclude their work on this topic and produce a solid standard. Energy Star is also collecting data on flicker and should complete their work and make recommendations before California produces its own specification.

If CEC is unwilling to remove the flicker specification and wait for agreement in standards organizations, then CEC should at the very least modify the present specification to allow use of the acceptable flicker region denoted by the red triangle in the figure above. We suggest modifying the specification to allow flicker in the region shown in the figure below. The specification would then be:

“Dimmer controls that can directly control lamps shall provide electrical outputs to lamps for reduced flicker operation through the dimming range so that the light output has an amplitude modulation below the line,  $\text{Modulation Depth} = 20\% + \text{Frequency}/10$ , for frequencies from 100 to 200 Hz, without causing premature lamp failure.”



Regarding requirements for laboratories conducting measurements described in JA8.2, while the wording for these requirements in JA8.2 implies that labs accredited under other agencies (i.e. A2LA) is acceptable, the new Table JA-8 in the 45-day language implies that only data from an accredited NVLAP test lab will be acceptable. We ask that this point be clarified. Furthermore, we find the wording in Section JA8.2, in general, is quite confusing; for example we propose the title of this section be changed to *Description of Test Apparatus and Test Lab Certification*, as there is no way to certify the test apparatus; it is simply described in UL 1598. We also propose that for noise and flicker measurements, the CEC add an exception in Section JA8.4.6 that NVLAP accreditation is not required for these measurements (similar to the DOE Laboratory Accreditation Program requirements described in 10 CFR 430.25), or simply state that these measurements may also be conducted by an accredited ISO/IEC 17025 test lab.

4. Joint Appendix 10 Flicker: We firmly oppose the entire draft language in Section JA10 regarding flicker measurements. While equipment pairing requirements for testing/listing purposes have been clarified, for non-incandescent lamp sources, the testing is proposed to be repeated for every dimmer/driver/lamp combination. This is a recipe for near-infinite testing, if manufacturers want their products to be usable with multiple dimmers. Furthermore it is unclear what number of lamps are to be tested, since the number of lamps can also affect dimming performance. Multiplication of; 1) the potential number of dimmer/driver/lamp combinations by, 2) the number of lamps supportable by the dimmer by, 3) the number of dimmer setpoints by, 4) the number of required frequency cutoffs yields a huge number of tests for one lamp. Even if a manufacturer did do all this testing and reported all the data, it is unclear what CEC would do with it or how it would prove beneficial. One may interpret the requirement such that audible noise should also be measured at all of these same conditions, further multiplying the number of tests. A huge amount of testing could be done, at great expense and increased cost of products, but the

proposed testing does not assure compatibility<sup>13</sup>. CEC should simply require manufacturers to maintain compatibility lists for dimmer/lamp combinations (as is now done in ENERGY STAR).

We believe the number of measurements as defined in JA10.5 and the subsequent data analysis and reporting as defined in JA10.6 and JA10.7, respectively, are overly prescriptive and complex and, as such, will impose an undue burden on manufacturers. In addition, under the current proposal, it will be difficult if not impossible to determine in the field which combinations have been tested and are allowed to be installed, potentially increasing the confusion of and burden on building inspectors.

The proposed test method and requirements are not well-substantiated: A sampling frequency of double the highest frequency within the signal to be measured is sufficient. Since the maximum flicker frequency that CEC cares about is 200 Hz, the sampling frequency should be greater than 400 Hz. JA10.5 requires a frequency measurement rate of 20 kHz (JA10.5). This is a factor of 50 times more data than necessary to characterize the specified flicker.

JA10's methodology goes all the way to 0 Hz frequency. This is physically impossible to characterize. The measurement time of 2 seconds is one full wavelength at 0.5 Hz. A measurement time of several wavelengths is generally necessary to characterize behavior at a particular frequency. CEC must raise the lower frequency limit to have some reasonable correspondence with the specified data collection time.

The test procedure, if CEC insists on adding it, should be no more complicated than the procedure presently in use by ENERGY STAR. We see no reason to require testing/calculation with 5 different frequency cutoffs (1000, 400, 200, 90, 50 Hz), when the specification only requires one value (200 Hz), and see no reason to complicate testing by requiring additional dimmer set points as compared to the ENERGY STAR requirements. We do not see any test lab requirement for the measurements described in JA10, and suggest that, if these measurements are to be conducted, to clarify these requirements to also align with the DOE Laboratory Accreditation Program requirements described in 10 CFR 430.25, or simply state that these measurements may also be conducted by an accredited ISO/IEC 17025 test lab.

5. Joint Appendix 10: As noted in footnote 6 above, NEMA has been informed that the IEEE 1789 reference document has completed ballot and is being readied for publication. We again implore the CEC to not adopt a custom, one-off Flicker Test Procedure in favor of a collaboratively developed scientific document. Proposal: strike Joint Appendix 10 and hold a public Flicker workshop in late-2015 to review IEEE 1789 and collaboratively develop a proposed language to incorporate it into both Title 24 and Title 20, as needed.

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<sup>13</sup> DOE article in LEDs Magazine: <http://www.ledsmagazine.com/articles/print/volume-11/issue-3/features/programs/led-lighting-progresses-driven-by-lessons-learned.html> Lesson 1: Rigorous testing requirements adopted in the early days of SSL industry development were necessary to counter exaggerated claims of performance by some manufacturers, but they eventually led to unreasonably high testing costs.

6. Luminaire Modifications in Place provisions: NEMA disagrees with the Commission's decision to remove the 2005 and 2008 Title 24 requirements which required Lighting Controls systems for retrofits. While we sympathize with the confusion expressed by lighting retrofit companies on the March 2<sup>nd</sup> webinar and in written comments, we agree with Commission staff's verbal response to these complaints during webinar that these difficulties can be mitigated with compliance training and other informative measures. Modifying Table 141.0-E to be more inclusive and allow strategies beyond the use of dimming ballasts/drivers, removing the word "mandatory", and changing "luminaire" to "enclosed space" are appreciated. However, we do not believe that increasing the threshold for triggering compliance with Section 141.0 from 10% to 20% will have a demonstrable effect. With these comments in mind, NEMA proposes that CEC redact the proposed adjustment to the Exception 2 to Section 141.0(b)2I and the proposed adjustment to Exception 2 to Section 141.0(b)2J both as presented at the March 3<sup>rd</sup> Hearing at CEC<sup>14</sup>. We also propose that CEC redact the proposed change<sup>15</sup> to the heading of the left hand column of Table 141.0E which strikes the word "Mandatory" and changes "20%" to "10%". We feel the long-standing existing requirements are adequate and confusion in the field can be mitigated with training and outreach as noted in the March 3<sup>rd</sup> hearing.
7. Section 140.7, Outdoor Lighting Power Allowances: We note that in the CASE report<sup>16</sup> for outdoor LPA, it was noted that the standard for recommended parking lot and parking garage design criteria (IES RP-20) was in revision and further the CASE study team suggested that CEC might ignore the update if the revision called for greater lighting allowances. We urge the CEC to incorporate IES guidance, regardless of whether it might increase LPAs, and in this case update the LPAs for Outdoor Lighting to be consistent with the IES RP-20-2014 standard. While the increased lighting allowance may slightly reduce the estimated increase in energy savings by some small margin, it should be preferable to negatively impacting safety issues. The Purpose and Scope section of RP-20 states: "These recommendations include interior and exterior lighting practices for the reasonably safe movement of vehicular and pedestrian traffic in parking facilities, the enhancing of personal safety and security and the deterring of vandalism and theft, while optimizing energy use and minimizing maintenance." We ask the CEC to consider whether by refusing to incorporate this revised guidance they are adopting a policy to selectively incorporate or ignore safety recommendations. This could pose a liability problem for a facility built to the proposed Title 24 practice experience some negative safety event with resulting litigation.

<sup>14</sup> [http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016-03-02-03\\_workshop/presentations\\_03-03/D2-7\\_Part\\_6\\_Subchapter\\_6-Lighting\\_Language\\_Preview.pdf](http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016-03-02-03_workshop/presentations_03-03/D2-7_Part_6_Subchapter_6-Lighting_Language_Preview.pdf)

<sup>15</sup> See the preceding link

<sup>16</sup>

[http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/dru\\_title24\\_parts\\_01\\_06/2016%20T24%20CASE%20Report%20-%20Outdoor%20LPA%20-%20Dec%202014-V3.pdf](http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/dru_title24_parts_01_06/2016%20T24%20CASE%20Report%20-%20Outdoor%20LPA%20-%20Dec%202014-V3.pdf) P25/163 "The IES is in the process of producing a new Recommended Practice (RP-20) that addresses parking lot and parking garage lighting design criteria. This may apply to the general hardscape lighting criteria that should be applied in the LPA calculations. At this point, the new document is not available for review and has not been approved, so it is impossible to gauge precisely what the impact of the new design criteria will be, but preliminary reports indicate that it will considerably increase light levels to meet the new criteria. Since the document is not finalized, and because the Title 24 update process must continue on its schedule to meet the CEC's deadlines for the public process, the Statewide CASE Team has not made changes to the design criteria. However, if the new IES document does increase the energy consumption required to meet the criteria, the recommendation of the Statewide CASE Team may be to disregard the new RP-20 document and consider different sources for design criteria."

This potential liability is easily avoided by incorporating the new IES recommendations into the LPA calculations.

8. Labeling: We strongly disagree with the IOU proposals that State-specific label or labeling requirements be established, as described in JA8.5 and Table JA-8. In addition to the valuable surface area consumed by these unnecessary labels, the additional costs and difficulty of assuring proper distribution are not justified by the intangible benefits pursued by the proposals<sup>17</sup>. CEC has routinely stated their intent to set a trend for other States to follow. A State-specific label is not in keeping with their attempts to set a standard that can be adopted at the national level. An acceptance of our proposal to not create State-specific requirements also respects manufacturer's tendencies to produce and label products for sale in multiple regions.

As agency labeling requirements continue to grow, and as the advances in technology allow light sources and luminaires to be more compact and smaller in size, there will be less and less physical space available for markings. Existing labeling practices are already challenged to meet Federal and other disclosure and marking requirements while being simple to read and understand. It is becoming impossible to accommodate all the markings required to be on a specific location for the given product. Furthermore, the obstructions made by labels on a luminaire's optical system may impact energy efficiency. We strongly urge the CEC to align with other existing agency marking requirements and formats to consolidate and reduce required marking text. For example, manufacturing date codes are already required for other agencies, without having specific formats.

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<sup>17</sup> DOE article in LEDs Magazine: <http://www.ledsmagazine.com/articles/print/volume-11/issue-3/features/programs/led-lighting-progresses-driven-by-lessons-learned.html> Lesson 1: Rigorous testing requirements adopted in the early days of SSL industry development were necessary to counter exaggerated claims of performance by some manufacturers, but they eventually led to unreasonably high testing costs.

## Appendix of Changes to Definitions

<b>Title 24</b>	<b>IES</b>	<b>Comment</b>
Compact Fluorescent Lamp is a fluorescent lamp less than 9 inches maximum overall length (M.O.L.) with a T5 or smaller diameter glass tube that is folded, bent, or bridged.	Compact fluorescent lamp is a fluorescent lamp with a small diameter glass tube (T5 or less) that is folded, bent or bridged to create a long discharge path in a small volume. The lamp designs generally include an amalgam and a cold chamber, or a cold spot, to control the mercury vapor pressure and light output.	Use IES
Illuminance is the incident luminous flux density on a differential element of surface located at a point and oriented in a particular direction, expressed in lumens per unit area.	Illuminance is the area density of the luminous flux incident at a point on a surface	Use IES
Light Emitting Diode (LED) definitions used in Part 6 are in Section 6.8 of ANSI/IES RP-16-10.	Light emitting diode is a p-n junction solid state diode whose radiated output is a function of its physical construction, material used and exciting current. The output may be in the near ultraviolet, the visible or in the infrared regions of the spectrum.	Use IES
Lumen Maintenance is a strategy used to provide a precise, constant level of lighting from a lighting system regardless of the age of the lamps or the maintenance of the luminaires.	Lumen flux maintenance is the remaining luminous flux output (typically expressed as a percentage of the initial luminous flux output) at any selected elapsed time. Luminous flux maintenance is the converse of luminous flux depreciation.	Proposed change: A lighting control strategy that provides at least three light levels—one at full-ON or at a high light level and two or more at lower levels. This may include turning off some portion of the lighting so that uniform light level and distribution is maintained. In addition to the three ON settings, multi-level control may provide for full-OFF. Continuous dimming systems meet this requirement. Also known as multi-level switching or stepped switching.
Luminaire is a complete lighting unit consisting of lamp(s) and a light source such as a lamp or lamps, together with the parts that distribute the light, position and protect the lamp(s), and connect the lamp(s) light source and connect it to the power supply.	Luminaire (light fixture) - A complete lighting unit consisting of a lamp(s) and ballast(s) (when applicable) together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply	Use IES
Pendant is a mounting method in which the luminaire is suspended from above.	Suspended (pendant) - A luminaire that is hung from a ceiling by supports	Use IES
Radiant Power is the time-rate-flow of radiant energy.	The time rate of flow of radiant energy. It is expressed preferably	Use IES

	in watts.	
Radiant Energy is the electromagnetic or photonic radiant energy from a source.	Radiant energy is energy traveling in the form of electromagnetic waves. It is measured in units of energy such as joules or kilowatt hours.	Use IES
Recessed Luminaire is a luminaire that is mounted above the ceiling or behind a wall or other surface with the opening of the luminaire level with the interior surface.	A luminaire that is mounted above the ceiling (or behind a wall or other surface) with the opening of the luminaire level with the surface.	As noted in our comments: The intent of this definition within the standard should only apply to recessed downlights. Either change the definition to include downlights only or change the reference in the Standard from “recessed luminaire” to “recessed downlight”
Multi-Level Lighting Control reduces power going to a lighting system in multiple steps.	None	A lighting control strategy that provides at least three light levels—one at full-ON and two at lower levels. This may include turning off some portion of the lighting so that uniform light level and distribution is maintained. In addition to the three ON settings, multi-level control may provide for full-OFF. Continuous dimming systems meet this requirement. Also known as multi-level switching or stepped switching. <sup>18</sup>
Photo Control automatically turns lights ON and OFF, or automatically adjusts lighting levels, in response to the amount of daylight that is available. A Photo Control may also be one component of a field assembled lighting system, the component having the capability to provide a signal proportional to the amount of daylight to a Lighting Control System to continuously dim or brighten the electric lights in response.	A photoelectric switch that controls lighting by the level of daylight illuminance.	Strike CEC word “continuously”. (Cite the T8 requirements for step dim.)

<sup>18</sup> This definition is from NEMA White Paper LSD-64, “Lighting Controls Terminology”  
<http://www.nema.org/Standards/Pages/Lighting-Controls-Terminology.aspx>