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Philips Lighting comments on Reinstatement of NEMA 77

Additional submitted attachment is included below.

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February 14, 2018

Submitted via website: https://efiling.energy.ca.gov/EComment/EComment.aspx?docketnumber=17-BSTD-02

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

Docket No.: 17BSTD-02

Philips Lighting Comments in Support of the Reinstatement of NEMA 77 as a Method for Qualifying Products to 2016 CA Title 24 JA8

Dear Mr. McAllister,

Philips Lighting appreciates the opportunity to provide the attached comments on the Express Terms for the 2019 California Building Energy Efficiency Standards California Code of Regulations, Title 24, Part 6.

Philips Lighting is a global leader in lighting products, systems, and services. Our understanding of how lighting positively affects people coupled with our deep technological know-how enable us to deliver digital lighting innovations that unlock new business value, deliver rich user experiences and help to improve lives. Serving professional and consumer markets, we sell more energy efficient LED lighting than any other company. We lead the industry in connected lighting systems and services, leveraging the Internet of Things to take light beyond illumination and transform homes, buildings, and urban spaces.

Please contact me if you have any questions about these comments.

Sincerely,

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We submit the following evidence to dispute the assertion that NEMA 77 is "backsliding" when compared with the JA8 specification as defined in JA10 2016.

This document summarizes the key rationale supporting use of NEMA 77 as a test method in the 2019 California Building Energy Efficiency Standards. A second document provides more detail on the rationale, as well as rebuttals to several comments posted to the docket which advocated the removal of NEMA 77.

We request that NEMA 77 be reinstated as a method for qualifying products to Title 24 JA8. Use of **NEMA 77 should be considered a strengthening of the requirements for temporal light artifact (TLA)**, not a weakening. NEMA 77 is a robust, real-world approach that applies the latest science and metrics (SVM and P_{st}) to the measurement of temporal light artifacts (TLA) and recommends appropriate limits for general lighting applications. It is founded on peer-reviewed studies published in journals such as Lighting Research and Technology, LUEKOS, and the Journal of the Optical Society of America[1].

Figure 1 plots TLA limits for the NEMA 77 test method and the JA10 2016 test method. The 'low risk' and 'no effect' limits of IEEE 1789 and conventional light source operational frequencies are plotted for reference.

For any particular measure, a point above the curve (at fixed frequency) is less stringent with respect to TLA, while a point below the curve is more stringent. The red shaded region shows that for the majority of frequencies where humans are most sensitive to flicker (< 60 Hz), NEMA 77 is far stricter in the limit it sets than the 2016 JA8 limits. The blue shaded region shows the small set of frequencies where the 2016 JA8 limit is stricter than NEMA 77.

We plotted the largest (most drastic) difference between NEMA 77 and 2016 JA8. The grey region (where NEMA 77 is less stringent than 2016 JA8) becomes smaller in real-world applications, because LED drivers do not typically have pure sine wave modulation. When more complicated light modulation is present, the SVM=1.6 curve will drop causing the size of the grey area to shrink.

[1] See the end of this document for a listing of NEMA 77's source material.

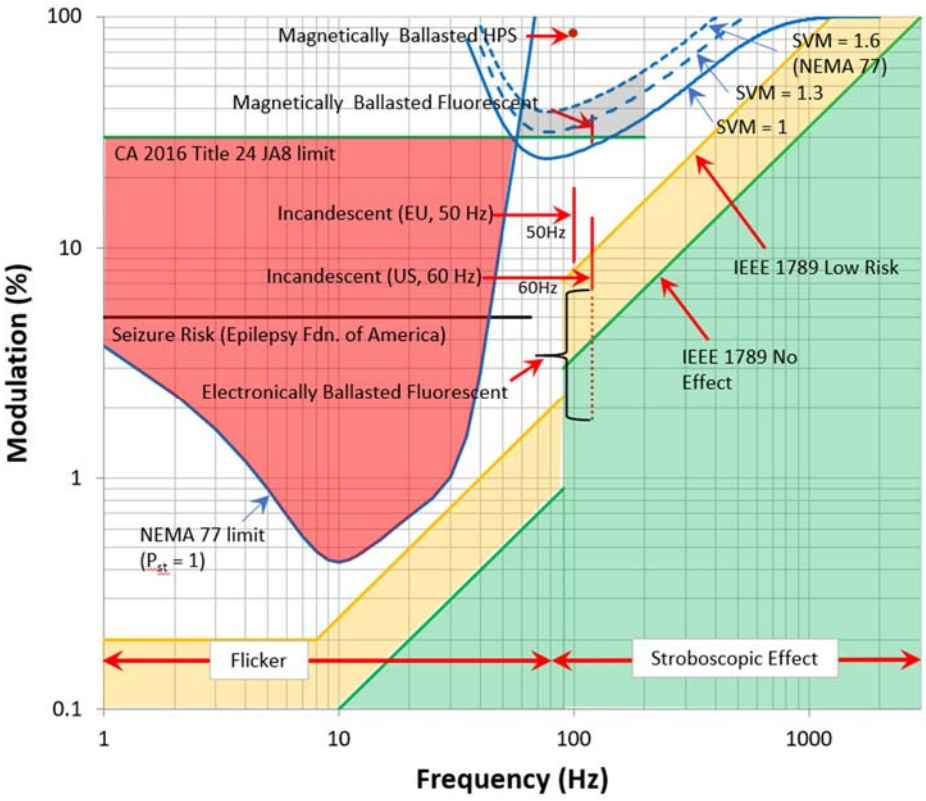

Figure 1: Comparison of TLA measures and conventional light sources.

NEMA 77 is much stricter than Title 24's present requirements in the frequency range where humans are most sensitive to TLA (below about 60 Hz) and where serious health effects may be caused by flicker. It is less strict than Title 24's present requirements at higher frequencies, where humans are less sensitive to TLA and health risks are low.

Two references were cited to show headaches and performance effects, to support the limits in 2016 JA8 (see 2016 CASE Report – Measure Number 2016-RES-LTG1-F and IES Conference publication). The modulation depth and frequencies used in these two references *do not support* the limit of 30% modulation depth set by 2016 JA8. The modulation depth and frequencies investigated in these two reports are avoided by a specification of SVM = 1.6, the guidance given in NEMA 77.

The measures of NEMA 77 (SVM and P_{st}) are recognized by the US EPA and are currently in use within its Energy Star product certification program. These metrics are being seriously considered by IES, IEC, CIE, and several Chinese standard development organizations for inclusion in multiple standards and regulations globally.

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NEMA 77 Sources:

Małgorzata Perz, Dragan Sekulovski, Ingrid Vogels & Ingrid Heynderickx (2017). Quantifying the Visibility of Periodic Flicker, LEUKOS, DOI: 10.1080/15502724.2016.1269607

Małgorzata Perz, Dragan Sekulovski, Ingrid Vogels & Ingrid Heynderickx (2018). Stroboscopic effect: contrast threshold function and dependence on illumination level, Journal of the Optical Society of America, Vol. 35, No. 2

Perz, M., Vogels, I., Sekulovski, D., Wang, L., Tu, Y. and Heynderickx, I. (2014). Modeling the visibility of the stroboscopic effect occurring in temporally modulated light systems, Lighting Research and Technology, 1477153514534945, first published on May 13, 2014

Sekulovski, D., Perz, M. and Vogels, I. (2012). Modelling the visibility of the stroboscopic effect, Proceedings of CIE 2012 Lighting Quality & Energy Efficiency, Hangzhou, China, 439-449.

Vogels, I., Sekulovski, D. and Perz, M. (2011). Visible artefacts of LEDs, Proceedings of the 27th Session of the CIE, 42-51.

ASSIST recommends, "Recommended metric for assessing the direct perception of light source flicker," Vol. 11, Issue 3, 2015. http://www.lrc.rpi.edu/programs/solidstate/assist/pdf/AR-FlickerMetric.pdf

ASSIST recommends, "Flicker Parameters for Reducing Stroboscopic Effects from Solid-state Lighting Systems", Vol. 11, Issue 1, May 2012. http://www.lrc.rpi.edu/programs/solidstate/assist/pdf/AR-Flicker.pdf