

ENERGY STAR Lamps V2.1 Draft Comment Summary and Response

Topic	Subtopic	Comment Summary	EPA Response
Allowable Variation	CRI	One stakeholder provided multiple datasets and commented that CRI as an allowable variation would be reasonable as the lifetime and color maintenance test results were highly similar (perform comparatively).	EPA would like to receive additional 6,000 hour test results from other stakeholders to help inform future EPA consideration of CRI as an allowable variation.
Allowable Variation	Driver dependent items	One stakeholder commented that the allowable variations section should not include additional Dimming, Flicker, and Audible Noise testing for product variations, since results from these tests are primarily influenced by the LED driver, not components covered under allowable variations.	EPA agrees that noise is directly influenced by the LED driver and not the LED and, therefore, has removed it as an additional test for LED package variations. EPA seeks more information including test data to show that change of LEDs has no impact on dimming performance or flicker.
Allowable Variation	Junction Temperature	A manufacturing stakeholder commented that rated thermal resistance of the LED is not a reliable parameter for evaluating LED package variations, and provided data for likely scenarios where a cooler junction temperature was observed on a variant LED with higher thermal resistance.	EPA is proposing to revise the first condition for evaluating LED packages as allowable variations to read “the measured junction temperature (Tj) and package case temperature (Tc) ≤ the LED package of the representative model.”
Allowable Variation	LED Package Variation	<ul style="list-style-type: none"> • Multiple Stakeholders expressed support for the addition of LED Packages as an allowable variation. • One stakeholder requested clarification whether this allowable variation mechanism covers changes in the quantity of LED packages, if all requirements were met. • One stakeholder recommended that products using LED package variation should be required to submit 3000 and 6000 hour lumen maintenance data. • One stakeholder requested clarification between the Package Variation of Lamps V2.1 and the Use of LM-80 Data, regarding the requirements: efficacy is greater than or equal to the representative model and the measured light output is greater than or equal to the representative model. This stakeholder also noted that the requirement that the Ra and R9 greater than or equal to the representative model could be in conflict with other requirements as typically lumen maintenance, efficacy, and light output are reduced in products with higher Ra/R9 values, due to increased phosphor conversion. 	EPA has clarified the language in the LED Package Variation section. For products with additional LED packages, this would be an allowable variation if all requirements were met. EPA is confident the proposed additional testing requirements are sufficient for the ENERGY STAR program and reminds manufacturers that any variation could be tested during Verification Testing and would be expected to pass 6,000-hour product-level lumen maintenance testing.
Considerations for Future Revisions	IEC/TS 62861	One stakeholder commented that the Lamps Specification referenced IEC 62861, whereas IES has developed a further standard based on IEC 62861. This stakeholder was interested in the reasoning for remaining with the IEC 62861 standard in the Lamps Specification.	The IEC standard is listed as a consideration for future revisions because the IEC standard is meant to encompass all essential components of a lighting product, not just the LED. The IES LED robustness standard is a helpful tool for the supply chain, but at this time EPA is most interested in end product reliability testing, and if a combination of component reliability tests can serve that need.

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Elevated Temperature Light Output Ratio (ETLOR)	COB Temperature Dependence	<p>One stakeholder commented that chip-on-board (CoB) LEDs under elevated temperatures have a greater loss of light output than comparable multiple LED designs and provided data to support this claim. Because CoBs are now being used in high-output directional LED lamps with input power that exceeds 20W and, since ENERGY STAR requires these to be tested at 55 °C instead of 45 °C, this stakeholder requested a relaxing of the ETLOR requirement for directional products with input power > 20W.</p>	<p>The data presented suggests a fundamental technological challenge for high-output, multi-die LED packages (sometimes referred to as “Chip-on-Board” LEDs). EPA seeks more information from stakeholders on this topic to help inform future consideration of the ETLOR requirement for products incorporating high-output, multi-die LED packages.</p>
Flicker	Metrics	<p>Multiple stakeholders commented on the flicker requirements in the Lamps V2.1 Draft 1 Specification.</p> <p>Two stakeholders recommended that the specification use the NEMA SSL-7A and corresponding NEMA 77-2017 Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria (released on April 1, 2017), instead of the ASSIST Metric. One of these stakeholders provided supporting information on the two flicker metrics used in NEMA 77-2017, Pst (which measures visible flicker) and SVM (which can account for stroboscopic effects), and compared their results to the ASSIST Metric. This stakeholder noted that the ASSIST Metric only accounts for visible flicker, and does not account for stroboscopic effects, and has excessive noise for frequencies below 5 Hz.</p> <p>One utility group supported the inclusion of a test method that addresses perceptible flicker in dimmable lamps as part of the ENERGY STAR specification but recommended that it be a test method that has been carefully vetted with industry stakeholders and has been determined to be robust for the range of products and applications served by the ENERGY STAR Program.</p>	<p>Since the release of the draft of version 2.1, EPA had the opportunity to learn more about the efforts of the National Electrical Manufacturers Association’s (NEMA’s) Light Systems Division to establish a test method and standard for light source flicker. These efforts resulted in the April 1, 2017 publication of NEMA 77-2017, Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria. NEMA representatives have acknowledged that these test methods and standards are subject to change as new data comes to light.</p> <p>After evaluating NEMA 77 against EPA’s proposal for light source flicker, EPA proposes that testing for light source flicker be performed in accordance with NEMA 77-2017 with the following conditions:</p> <ul style="list-style-type: none"> • The value reported for M_p shall be based on analysis of the entire waveform dataset generated by the NEMA 77 test, calculating MP for each 2-second interval; and • The waveform digitizer (e.g., oscilloscope) used to capture the waveform data, used for the calculation of Pst and MP, must have $\geq 1000:1$ (60 dB) dynamic range of waveform amplitude. <p>EPA sees value in the way that the ASSIST metric assesses waveforms directly, avoids technology-dependent complexity, and accounts for human factors using a simple weighting function. Additionally, the ASSIST metric can be used as an analysis tool to provide more information of the nature of the flicker problem by identifying which frequencies contribute to flicker. Because the lighting industry has not fully embraced a single metric for light source flicker, EPA believes that the reported ASSIST Flicker Perception Metric (M_p) data will be useful for ongoing industry development of flicker metrics.</p>

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Flicker	Testing with SSL-7A	One stakeholder commented that the current flicker test methods should be updated to allow a product that meets SSL-7A to be tested on a single SSL-7A compliant dimmer for dimming and flicker performance requirements	SSL7A has always been a pathway for dimming. EPA has updated the language to more clearly indicate this by referencing the standard.
Included Products	AR111	One manufacturer recommended that the AR111 shape should be included in the Lamps Specification. This manufacturer noted that these lamp shapes are typically aggregated with MR16 and other low voltage lamps, so there is limited market information available on this product type, but still presents an opportunity for energy savings.	ENERGY STAR lighting specifications aim to cover the most commonly used residential lighting product types that will offer consumer the greatest savings over alternatives. AR111 products appear to be only commercial lighting products. To consider adding new lamp types to the scope, EPA requests information on the markets and applications this product type is used.
Lamp Life		<p>Multiple Manufacturer and Manufacturer organization stakeholders commented on the 15000 lamp life for directional lamps, generally in support of the revised requirement. Two stakeholders were in favor of immediate implementation of the new life requirements, whereas 3 other stakeholders recommended adding a 12 month delay prior to implementation, citing both the investment made in current products to meet the 25,000 hour requirement and the need for a product re-design to meet the new levels.</p> <p>One utility group supports the continued recognition and promotion of lamps with ≥25,000-hour lifetimes but recognizes the market benefits of ENERGY STAR establishing a 15,000-hour minimum lifetime requirement for all solid-state lamps.</p> <p>One manufacturer strongly advised against lowering the hours lifetime for PAR, MR, and MRX products, citing longer typical operating hours for these products. This stakeholder was not against the reduced lifetimes for R/BR/ER products, but recommended the 12 month phase in period for product redesign.</p>	<p>EPA appreciates partner's investments in the program and is sensitive to the business decisions partners make based on the program specifications. The market shows that even the partners who are requesting a delay in the minimum lifetime for directional lamps already have directional LED lamps in the market with lifetime ratings below 25,000 hours. With this in mind, EPA is proposing a July 3, 2017 implementation date for Version 2.1.</p>

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Lumen Maintenance and Lifetime	DOE Test Duration	<p>Multiple stakeholders commented on the shorter testing requirements in the DOE Test Procedure, requiring a minimum of 4400 hours for 15,000-hour lifetime claims, and recommended that the Lamps Specification adopt the shorter test duration.</p> <p>One of these stakeholders also noted that updating these test length requirements would also require a corresponding update to the Appendix B, Supplemental Testing Guidance table.</p>	<p>All LED lamps are eligible for early certification at 3,000 hours, to support speed to market, however EPA verification testing data and certification testing data to date demonstrate the need for continued surveillance at longer operating periods. Until this trend changes EPA will continue to evaluate products at 6,000 hours to ensure they are delivering on early interim performance claims. In lowering the minimum lifetime requirement EPA remains vigilant to ensure any value engineering does not jeopardize the overall expected quality for an ENERGY STAR certified product and delivers on the promise and lifetime rating shown to the consumer. This is all to protect consumer confidence in these products to support fast and widespread adoption and avoid mistakes that were made with CFLs.</p>
Lumen Maintenance and Lifetime	Operational Requirement	<p>Multiple stakeholders noted that the DOE Test Procedure only requires 6/10 lamps to survive during the testing period, which contrasts with the ENERGY STAR requirement that 10/10 lamps must survive. All of these stakeholders requested that EPA change the ENERGY STAR Test Procedure to allow 9/10 lamp survival.</p> <p>One stakeholder quantified the difficulty of achieving 10/10 passing lamps due to statistical arguments, if a manufacturer sets a 0.1% chance of verification testing failure for a product, the minimum failure rate for a product would be 48 of 10,000 for a 9/10 pass rate and 1 of 10,000 for 10/10. The 10/10 failure rate is extremely restrictive and requires that products are over-engineered to meet this requirement.</p>	<p>EPA notes the similarities between the 6000 hour test duration and number of failures allowed during the testing period. Verification Testing and Certification data show lifetime is still a concern so, until this changes, EPA will remain vigilant and continue to require 10/10 lamp survival to protect consumer confidence and avoid mistakes made with CFLs.</p>
Packaging		<p>A stakeholder requested clarification on packaging requirements for ENERGY STAR vs Federal Trade Commission (FTC) 16 CFR section 305.15 for General Service Lamps. Some potential conflicts include requirements to round to the nearest 5 for lumen output, measured vs reported values, and rounding to 3 significant digits. This stakeholder also requested additional guidance for situations where the partner was not claiming a wattage equivalency on the product.</p>	<p>EPA collaborated with DOE on this specification and these suggestions are not consistent with EPA's understanding of DOE requirements. Questions related to DOE rulemakings should be directed to DOE.</p>
In situ TMP _{LED}		<p>One stakeholder requested clarification whether a lamp that has passed the lumen Maintenance of 6000-hr test duration could be certified if the in situ TMP_{LED} is higher than the LM-80 test temperature.</p>	<p>Lamp level 6,000 hour data is what the program relies on for full certification, LM-80 and <i>in situ</i> testing results only support early initial certification, a passing 6,000 hour lamp level result supersedes component level results for full certification. EPA is interested in cases where this testing inconsistency may have occurred.</p>