

Topic	Subtopic	Comment	EPA Response
<b>Allowable Product Variations</b>		<p>In Draft 4 EPA expanded the allowable shared tests for products that are the same but vary in correlated color temperature (CCT) to include the sharing of safety, electrical, and dimming performance test data. This included allowance of sharing electrical testing and the rapid cycle stress test for CFLs and LED lamps that have the same construction but a different phosphor mix.</p> <p>Stakeholders continued to request additional variant categories such as heat sink material, CCT for LED lamps by testing with the lowest color temperature, and all variants outlined in the Luminaires V1.2 specification. One stakeholder erroneously noted that sharing the rapid cycle stress testing data for CCT variations is not allowed. One stakeholder commented that requiring lumen maintenance testing to 40% of rated life and run up time for each variant of CCT has no technical benefit and proposed using only 100-hr test data.</p> <p>A few stakeholders misinterpreted the language requiring “up to 5 samples” to be tested for variants as requiring 5 samples, instead of having the option to test between one and five samples.</p> <p>One stakeholder requested the alignment of product variance electrical tolerances with the requirements specified in UL 1993, specifically input current and input wattage at <math>\pm 10\%</math>.</p>	<p>EPA considered each request for allowable variations where technical justification was provided. The limited data EPA received did not support a clear worst case representative CCT lamp for all performance metrics but did show that performance over time is fairly consistent among the same lamp construction with only a change to the phosphor mix. With this information EPA has expanded the test data that may be shared for variations in CCT but leaves the worst case designation up to the manufacturer and their certification body with the reminder that the partner must be careful in assessing their risk and assumes the responsibility when it comes to verification testing. EPA is open to working with partners to collect data in support of additional test sharing for variations that could potentially be included in future revisions.</p> <p>In the final draft, EPA has aligned the allowed tolerance in the test report(s) for the tested representative model and the variant(s) for input current and input wattage values to the <math>\pm 10\%</math> permitted variance in UL 1993 compliance.</p>
<b>Center Beam Intensity</b>		<p>One stakeholder commented that current self-ballasted CFL PAR designs have beam angles of 120° or more and the CBCP tool for the Center Beam Intensity requirement limits the maximum beam angle of no greater than 40° for PAR lamps, which effectively eliminates CFLs in a PAR38 configuration from the specification.</p>	<p>PAR lamps traditionally provide an intense directional beam of light. CFLs cannot deliver the performance that is expected of a halogen PAR lamp, regardless of reflector design. To meet consumer expectations, EPA believes lamps claiming to replace popular incandescent ANSI shapes and sizes should match those claims by delivering the performance of these incumbent lamps. EPA recognizes that CFLs currently classified as PAR lamps will need to be reclassified for failure to meet the performance requirements for PAR lamps in the lamps specification. Given current trends EPA expects cost effective choices for directional lamps for various needs will be available to the consumer by the time this specification goes into effect, and lamp classification will be more meaningful as a result.</p>
<b>Correlated Color Temperature (CCT)</b>		<p>In response to stakeholder comments on manufacturing variance in Draft 4 the passing requirement for CCT was updated to be consistent with the existing CFL 4.3 and ILL 1.4 passing requirements for 9 of 10 samples to fall within 7-steps.</p> <p>Stakeholders noted the inconsistent passing language in the specification requirement and supplemental testing guidance for solid-state lamps.</p>	<p>EPA has corrected the final draft by removing old passing test language in the supplemental testing guidance section that was overlooked and inadvertently left in Draft 4.</p>

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Color Angular Uniformity (CAU)		A stakeholder commented that it is unavoidable to have increased chromaticity variation in high CCT LED lamps and recommended an increase in the chromaticity variation limit to 0.009 for lamps with CCT > 4000K.	EPA believes the established CAU levels are adequate for ensuring consistency of color across the beam as evidenced by the products on the qualified products list.
Color Rendering Index (CRI)	R <sub>9</sub>	<p>In Draft 4 EPA removed the R<sub>9</sub> &gt; 0 for CFLs and maintained the positive R<sub>9</sub> requirement for LED lamps.</p> <p>One stakeholder group supported the removal of R<sub>9</sub> requirements for CFLs and asked EPA to consider a higher R<sub>9</sub> value for LED lamps.</p> <p>A couple stakeholders commented that removing the R<sub>9</sub> requirement for CFL was not in line with EPA's technology-neutral specification efforts. One stakeholder recommended a negative 5 R<sub>9</sub> minimum level for both technologies, and the other stakeholder suggested the positive R<sub>9</sub> requirement should be removed from the spec for all sources, allowing LED lamp manufacturers freedom to lower lamp costs and focus on efficacy gains.</p> <p>Another stakeholder urged the Agency to maintain a positive R<sub>9</sub> requirement for CFLs to address the concerns over quality of light, noting that the method for achieving a positive R<sub>9</sub> value for CFLs is to simply switch to a slightly different mix of phosphors, which should not result in a significant increase in cost of or loss in efficacy.</p>	After careful consideration the Agency concluded that putting pressure on CFLs to overcome cost and efficacy challenges and to achieve a positive R <sub>9</sub> is no longer appropriate given current market conditions where investments in energy efficient lighting are focused on advancing SSL technology that will eventually eclipse compact fluorescent in efficiency and overall product quality. The positive R <sub>9</sub> requirement that has been in place for integral LED lamps from the beginning remains important for the advancement and adoption of this technology. EPA intends to collect R <sub>9</sub> data for all lamps going forward to better understand the impacts on efficacy and cost.
	R <sub>a</sub>	One stakeholder requested an allowance for lower CRI for high color temperature products, citing a relationship between higher efficacy and lower color rendering. The stakeholder requested a minimum R <sub>a</sub> of 77 for 5000K and 6500K lamps.	EPA believes the established CRI levels are adequate for ensuring the availability of high quality, efficient lighting solutions.

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<b>Dimming General</b>		<p>In Draft 4, EPA proposed testing both 1 and 4 lamps on a single dimmer due to variations in performance for one lamp versus four lamps on a given dimmer. EPA also confirmed that dimming performance testing would not be required to be performed by a third party laboratory, but would involve reporting of performance to an EPA-recognized certification body (CB).</p> <p>Some stakeholders commented that allowing the testing to be undertaken by the manufacturers is acceptable because the specification is in its infancy, and recommended the inclusion of third party certification and testing for dimming capabilities in future revisions of the specification.</p> <p>One manufacturing stakeholder commented that since the data is not being reviewed by the CBs and not being used for decisions regarding certification, the submission of the data to the CB does not add value and proposed manufacturer declaration only with data made available on the manufacturer's website.</p> <p>Another stakeholder commented that lamp manufacturers should not be held responsible for performance variations outside their control, suggesting there is no assurance that dimmer control manufacturer models have not made design changes over the years, nor is there any guarantee that it will not occur in future designs that may alter the dimming performance of the lamp.</p> <p>Stakeholders from the efficiency community suggested inclusion of additional requirements including pop-on and color shift while dimming.</p>	<p>Establishing dimming requirements for ENERGY STAR lamps is important to maintain consumer satisfaction. However, determining the requirements is a challenge since there are currently no industry testing, performance standards or laboratory methods to use as a reference. The dimming requirements in this specification lay the groundwork for consistent measurement and reporting of dimming performance and an opportunity to explore dimming for energy efficient lamps in greater detail.</p> <p>EPA is continuously monitoring progress that industry and others are making in the area of performance and measurement methods for dimmable products. During this period of exploration EPA is taking a strategic approach whereby testing and the results of testing are shared with EPA through CBs to help support EPA's specification development efforts while not subjecting manufacturing partners to the same level of scrutiny required for established test methods. At this stage, EPA is seeking a robust data set to inform future decisions and potentially refine the methods and requirements as needed. The Agency will continue further exploration of dimming requirements in consideration of future revisions, which could include looking at pop-on and color shift in a dimmed state.</p>
<b>Dimming</b>	<b>Maximum Light Output on a Dimmer</b>	<p>Draft 4 proposed a maximum light output range of no more than 10% over and no less than 20% below the lamp's light output when connected to a dimmer, and EPA clarified that the maximum light output on a dimmer/control be the measurement at the maximum setting of the control, not the maximum or rated light output of the lamp.</p> <p>One stakeholder group requested the light output on a dimmer while at its maximum setting should be no more than 10% below the full lumen output, noting the proposed 20% appears excessive.</p> <p>Another stakeholder commented that it is not a disadvantage for the consumers when the lamp's light output exceeds its rated light output, and suggested the maximum 10% overage requirement be removed.</p>	<p>EPA has removed the 10% cap on maximum light output believing that consumers may not notice or are not likely to be dissatisfied with a brighter lamp on a dimmer positioned at the maximum setting. EPA acknowledges that maximum light output level of a lamp on a dimmer is strongly correlated to the dimmer design and has maintained the lower light output threshold of 20%.</p> <p>In addition, EPA has clarified the maximum light output requirement language to make clear that the lamp's light output on the maximum setting of the dimmer is being compared to the lamp's measured baseline light output when operated without a dimmer.</p>

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Dimming	Dimmer Selection	<p>Some stakeholders supported the approach to differentiate testing requirements for lamps designed to be operated with varying kinds of dimmers/controls, i.e., legacy phase cut dimmers versus next generation dimmers. They also supported the requirement to test with 10 dimmers from 2 different manufacturers, believing it is a safeguard to ensure that the dimmer results are properly reflected in the self-reported testing.</p> <p>One stakeholder recommended that EPA develop a list of suggested dimmers for inclusion in the specification and suggested various dimmer models from Legrand, Lutron, Cooper, Enerlights, and Leviton be considered.</p> <p>One stakeholder commented that requiring testing with 10 dimmers is excessive and results in a significant testing burden for manufacturers. The stakeholder suggested testing with 2 to 4 dimmers. Other stakeholders suggested testing with 5 dimmers and limiting the type of dimmers to 2 with at least one dimmer compatible with energy efficient lighting.</p> <p>A dimmer manufacturer suggested reducing the number of dimmers for testing from 10 to 4 and testing with only dimmers that are specified as compatible for use with energy efficient lighting, citing safety certification and National Electrical Code (NEC) installation concerns. The stakeholder also suggested allowing lamp/dimmer combinations compliant with NEMA SSL7A as an alternative to testing with multiple dimmers. The stakeholder stated that dimmer categories such as “single/double phase shift,” “voltage compensation,” and “pre-set” are familiar to only the most-technically minded in the lighting control industry, and determining which dimmer model number falls into these categories will be difficult for others to confirm. Lastly the stakeholder commented that testing CFLs and LED lamps with random dimmers with which the lamps were not designed to operate will yield results that cannot be reproduced and recommended limiting the testing using a defined dimmer output voltage and a corresponding light level expected from the lamp.</p> <p>Some stakeholders expressed concerns with the dimmer selection language and recommended that EPA add language to ensure dimmers that vary only by their color or appearance and dimmers that are the same but have different manufacturer names do not constitute separate models that can be counted towards the 10 dimmer requirement. They also requested clarification of a dimmer specified as compatible use with energy efficient lighting and suggested a rated maximum wattage such as 150W.</p> <p>One stakeholder suggested adding language to the sample size allowing partners to indicate the minimum and maximum number of lamps compatible with the tested dimmer, stating it is not appropriate to limit the compatible number of lamp per dimmer since some dimmers may only be compatible with 2 lamps on the circuit.</p>	<p>As a result of the multiple comments regarding dimming compatibility, and while recognizing that dimming compatibility is challenging, EPA has updated the dimmer selection criteria, reducing the number of dimmers from 10 to 5, and allowing lamp manufacturers to specify the dimmers used for testing. The criteria for various types of dimmers with varying features have been abandoned due to dimmer manufacturer stakeholders confirming the near impossibility of identifying dimmers by circuit topology. The Agency provided a pathway for using NEMA SSL7A compliant lamp/dimmer combinations to reduce the number of dimmers once the NEMA SSL7A lamp and dimmer labeling scheme has been established. In response to stakeholders' comments, EPA also prescribed requirements for testing low voltage lamps, permitting lamp manufacturers to specify and report the transformer used during dimming performance testing.</p>

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<b>Dimming</b>	<b>Flicker</b>	<p>In Draft 3, EPA introduced a range of flicker index values for lamps with fundamental frequency of light output from 100 to 800 Hz. EPA set the frequency area of interest for flicker based on the industry research showing that flicker can be perceptible at higher frequencies, i.e. greater than 400Hz, through stroboscopic or phantom array effects, and flicker that is sensed, but not perceptible, or "not-visual" can still lead to adverse health effects.</p> <p>One stakeholder suggested that the flicker requirements should apply to all lamps, not just lamps marketed as dimmable. The stakeholder recommended a maximum flicker index of 0.12 and maximum 20% flicker for all frequencies.</p> <p>One stakeholder suggested that percent flicker should be used as the flicker metric instead of flicker index and recommended 400 Hz instead of 800Hz as the frequency endpoint, citing data that infers 100% flicker at 450Hz is not noticeable. Another stakeholder suggested the flicker index requirement be revised to 0.15 for all frequencies 120 Hz and above.</p> <p>One stakeholder commented that proposed flicker requirement is tight and has the potential to limit the flexibility of design and prevent the development of LED lamp technology. The stakeholder suggested a maximum flicker index of 0.4 at 120 Hz increasing linearly to 0.8 at 800 Hz.</p> <p>One stakeholder commented that tightening the flicker requirement should be considered in the future, as cost will increase to meet the tighter flicker specification, and energy storage within the lamp will have to increase in order to decrease flicker. The stakeholder suggested returning the proposed requirement in Draft 3.</p> <p>One stakeholder commented that the proposed flicker requirements are unnecessarily restrictive and cited studies that indicate frequencies from 160-200 Hz may be sufficient to limit flicker for biological effects. The stakeholder stated that no studies are showing actual health risks for frequencies above 100 Hz, and argued that studies with acceptability ratings for flicker are extremely subjective. One stakeholder commented that there are no definitive studies that correlate a flicker index measurement to flicker acceptability, perception, or hazards, and referenced a study that indicated flicker index may not be a suitable metric for stroboscopic effect, and a new metric should be developed.</p>	<p>After reviewing additional research submitted by stakeholders that revealed varying conclusions on acceptable levels of perceived and stroboscopic flicker, EPA updated the flicker performance requirement to include only the reporting of light output frequency, percent flicker and flicker index values.</p>

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<b>Dimming</b>	<b>Noise Testing</b>	<p>Draft 3 indicated measuring noise at distances of 1 foot and 1 meter were being considered and tested through round robin testing. In Draft 4 EPA proposed testing noise at a distance of 1 meter for all dimmable lamps and asked stakeholders to comment on this approach.</p> <p>Some stakeholders suggested measuring for audible noise with multiple lamps in the circuit, believing that multiple lamps often increase the audible noise on the line as compared to one lamp.</p> <p>One manufacturing stakeholder suggested flexibility in noise testing, to allow the measurement to be taken at 1 meter or less.</p> <p>One stakeholder commented that the number of dimmers used for noise testing should be limited in order to reduce the burden of testing and increase lab capacity. The stakeholder recommended testing the “worst-case” dimmers selected for overall dimming testing and run the unit at full power and at fully dimmed level.</p> <p>One stakeholder commented that there was not a significant difference in noise level of one particular lamp versus 4 lamps attached to the output of the dimmer, and the dimmer setting, e.g. 100%, 75%, etc. was a larger factor, based on their internal testing. The stakeholder suggested testing one lamp on the output of a dimmer when the dimmer is set to 50% dim level.</p>	<p>EPA has revised the test distance for audible noise to 1 meter or less, allowing testing flexibility without compromising limits on sound levels.</p> <p>The measurement points for the noise test were designed to coincide with the measurement points for flicker and light output on a dimmer. Without any evidence behind what point is worst case, EPA will look at the data that comes in, including results of any additional measurement points not outlined in the recommended practice and will consider adjusting the recommended practice in the future.</p>
<b>Effective Date</b>		<p>In a note box in Draft 4, EPA clarified that the effective date would be 12 months from the date of publication, and that the time period takes into consideration product development cycles and new testing requirements, as applicable to each product category. EPA further clarified the complete timeline for stakeholders to allow for a smooth transition between specifications while more immediately rewarding more efficient, higher quality designs.</p> <p>One stakeholder commented that partners need to understand the level of testing required and requested clarification on the testing needed to re-certify a lamp previously certified to the requirements in the Integral LED Lamps specification to the Lamps V1.0 specification. Other stakeholders commented that a longer transition period is needed, noting that testing all products per the new specification will inundate testing labs with several requests at one time, resulting in limited testing capacity.</p>	<p>Lamps Version 1.0 will take effect on September 1, 2014. Manufacturers are encouraged to begin testing and certifying products to this specification as soon as it is final. Recognizing the longer testing time frames associated with this specification the agency has allowed a year for transition. As of the Version 1.0 effective date, only those products that have been certified to the new requirements will appear on the Qualified Product List.</p>

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Efficacy	Dimmable CFLs	EPA received a comment that dimmable lamps incorporate additional circuitry to perform the dimming functions and have an inherently lower efficacy. One stakeholder requested a provision for a lower efficacy threshold for dimmable CFL lamps, in alignment with the existing requirements in CFL V4.3 specification.	EPA has evaluated current certified products and found no strong correlation in the data between dimmability and efficacy.
	Reported Values	<p>Some stakeholders generally supported the effort to harmonize testing and reporting methods for DOE-covered products and also recommended a single test method and reporting requirement, using the calculation for luminous efficacy as <math>\Phi_c = \Phi * 1.03</math>, the method from IES LM-66-11 or LM-79-08, and requested the reported value be the average.</p> <p>One stakeholder expressed concern that the optional tolerance of 3% on the initial luminous flux measurement should be clarified, and suggested that it be applied to either all measurements or only if the average of all measured lamps fails to meet the light output or efficacy requirement.</p>	Applying a tolerance across all values is the same thing as lowering the specification levels and does not benefit the program or consumers. Applying a tolerance for units whose test results are just slightly on the cusp of meeting the requirements and accounting for possible measurement error is the intent of the tolerance. EPA has revised the language based on stakeholder suggestions to clarify when the tolerance can be applied.
Efficacy	High CRI	<p>One stakeholder commented that EPA is overlooking lighting quality by not allowing reduced efficacy levels for high CRI lamps and suggested that EPA explore more thoroughly the trade-offs among efficacy, color rendering and lighting quality to boost consumer acceptability of energy efficient products.</p> <p>One manufacturing stakeholder suggested a higher efficacy tier for products with a CRI values between of 80 and 90, stating this will increase overall energy savings through enhanced adoption of high quality lamps as well as through more energy efficiency in lamps with lower CRI values.</p> <p>A number of stakeholders commented that a reduction in efficacy in exchange for a higher CRI is not in the best interest of this specification and supported the preservation of maintaining the efficacy requirements in the draft.</p>	The agency believes that differentiating products into CRI bins is not supported by the expectations of the average light bulb purchaser. In the context of a recent FTC rulemaking, there was general agreement that disclosure of CRI would not help consumers, particularly when minimum levels are set at 80.

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<b>Labeling &amp; Packaging</b>	<b>Packaging</b>	<p>In Draft 3, EPA replaced the Minimum Operating Temperature requirement with the Minimum Starting Temperature packaging requirement in response to stakeholders' requests.</p> <p>Some stakeholders requested that model numbers and retail SKU numbers be allowed on the bottom of packaging, as it is common practice. Another stakeholder noted that the use of "minimum operating temperature" is also common practice, and requested the option of using either starting or operating language.</p> <p>Another stakeholder requested the flexibility of either providing the complete written warranty printed on the packaging exterior or including it with the packaging as long as the packaging includes a website address where the complete written warranty is available.</p>	<p>The intent of the packaging requirements is to help ensure that consumers have adequate information when making the purchasing decision. EPA recognizes that some product packaging space may be limited and has adjusted the packaging language to allow model numbers and retail SKU numbers to be located on the bottom of lamp packaging. The Agency continues to seek specific information on packaging size limitations.</p> <p>EPA has revised the minimum starting temperature requirement, permitting manufacturers the flexibility of declaring and reporting either minimum operating or starting temperature.</p> <p>The complete written warranty may be printed on the lamp packaging exterior or included within the lamp packaging as noted in section 15.3 Warranty.</p>
<b>Labeling &amp; Packaging</b>	<b>Lamp Labeling</b>	<p>In Draft 4 the Agency requested that manufacturers, who have specific products with limited labeling surface area that cannot accommodate the required lamp labeling information, bring these cases to the Agency's attention.</p> <p>A few stakeholders commented that it will be exceedingly difficult to find room on MR-16 lamps to include the required labeling along with other regulatory labeling. They requested reduced lamp labeling requirements for MR-16 lamps. One stakeholder requested the allowance of a peel-off label that will be removed prior to use or another temporary system that provides the information but is not part of the product permanently.</p> <p>One stakeholder commented that the lamp labeling requirements are excessive and requested that beam angle and CCT be required on the package only, since the packaging is the visible interface with the consumer when purchasing the lamp.</p>	<p>At this time EPA has determined MR16 lamps have enough room for the limited labeling requirements since some manufacturers are already including all the information on these small products. The use of a peel-off label or other temporary means of conveying product information provides no benefit to the consumer when attempting to replace the lamp that is already installed.</p>

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<b>Lifetime</b>		<p>In Draft 4, EPA maintained the minimum 10,000-hour rated lifetime for compact fluorescent lamps, including covered CFLs.</p> <p>One manufacturing stakeholder supported the minimum 10,000 hour rated life requirement for all CFLs. A few manufacturing stakeholders commented on the minimum lifetime requirement for covered CFLs, citing that it would be particularly difficult for those products to last 10,000 hours in elevated temperature testing, and requested a reduction in the minimum rated life requirement to 8,000 hours for covered CFLs.</p> <p>Another stakeholder requested a change in the passing criteria, allowing one unit failure at 1000-hr, and two units failures at 40% of rated life.</p>	<p>Lifetime requirements for CFLs, including passing criteria, remain unchanged from previous Drafts. EPA offered tradeoffs in Draft 4 to accommodate decorative and general purpose CFLs with covers. With these CFLs exempt from elevated temperature testing, current qualified product data supports the capability of these products to last 10,000 plus hours. Covered CFLs have performed poorly in verification testing, with the largest number of test failures compared to bare CFLs, and the greatest number of failed tests associated with covered lamps rated less than 10,000 hours. EPA believes that higher lifetime requirements drives higher quality components and that enough product can meet the requirements to provide consumers with ENERGY STAR certified options for high quality, long lasting, energy-saving replacement lamps.</p>
<b>Light Output</b>		<p>In Draft 4 EPA proposed an optional tolerance to be applied on initial luminous flux values of each unit, consistent with DOE regulations for medium base CFLs.</p> <p>One stakeholder requested a clarification on the application of the 3% tolerance permitted in the supplemental testing guidance of the light output requirement.</p> <p>One stakeholder group requested that the “Decorative” section of light output requirement table specifically identify CFLs in the column currently titled “Covered A-lamp” to provide clarity.</p> <p>One stakeholder asked for a clarification of the required light output requirement for omnidirectional lamps claiming equivalency to lamps greater than 150W.</p> <p>Another stakeholder suggested that BR20 lamps be added to the exemptions permitted for BR30 and BR40 lamps, which allows a lower light output multiplier of 10X, and believes that BR20 lamps should not be required to meet a higher lumen output than BR30 and BR40 lamps of the same wattage equivalency.</p>	<p>EPA has updated both the efficacy and light output requirement to clarify the tolerance is applicable to the measured initial luminous flux value, and clarified that the 3% tolerance is only to be applied if the average of all measured lamps fails to meet the requirement without the tolerance.</p> <p>EPA has updated the column header and included an additional footnote to clarify that covered “A-shape” general purpose CFLs may be evaluated similar to decorative lamps for every requirement with the exception of minimum light output required for equivalency claims to general purpose incandescent lamps.</p> <p>Based on the demand for higher lumen products, EPA conducted a review of commonly available 200W and 300W omnidirectional incandescent medium base lamps and added corresponding light output level ranges based on the rated performance of these higher wattage incandescent lamps.</p> <p>EPA conducted a review of commonly available incandescent reflector lamps and determined that incandescent/halogen BR20 and other lamps that could be subject to higher light levels than the types that are exempted by the 10X rule, do not exist. In the review EPA also determined that the BR20 shape does not have a lamp space drawing in ANSI C78.21-2011.</p>

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Lumen Maintenance	Elevated Temperature Life Test	<p>In Draft 4, EPA exempted omnidirectional lamps labeled “not for use in enclosed fixtures” and all lamps labeled “not for use in recessed luminaires” from lumen maintenance testing in an elevated temperature environment, believing that the restrictive product markings required for lamp safety certification, which are intended to prevent consumers from installing lamps in incorrect luminaire types, minimize the need for elevated temperature life testing for lamps with restrictive labeling.</p> <p>Several stakeholders requested a clarification of the exemption from the elevated temperature life testing of lamps marked not for use in enclosed fixtures and not for use in recessed fixtures, and suggested varying language and formats intended to provide clarity.</p> <p>A few stakeholders requested exemptions from elevated temperature testing, particularly for all non-directional CFLs, citing the increased cost of these lamps to consumers to cover the required improvements to comply with the increased duration and temperature of lifetime testing, and directional lamps whose wattage is less than 10W, suggesting these lamps are not typically intended for high heat environments.</p> <p>One stakeholder commented that requiring higher wattage LED lamps (directional greater than 20W) to be tested in an elevated ambient of 55°C is not necessary since larger lamps normally have extensive thermal management designs, and proposed 45°C as the test temperature. Another stakeholder commented that the specification does not provide a base-down elevated temperature life test option for directional lamps greater than 20W.</p> <p>One stakeholder commented that EPA should maintain the requirement to test all lamps in an elevated temperature environment, and not allow manufacturers the option of leveraging the restrictive markings, e.g. “not for use in enclosed fixtures” on the package as a means to avoid lumen maintenance testing in an elevated temperature condition. The stakeholder also suggested that omnidirectional lamps should be tested in an elevated temperature environment to ensure lamps placed in enclosed fixtures do not fail prematurely and discourage consumers’ purchase of LED lamps.</p>	<p>The exemptions for elevated temperature life testing remain unchanged in the final draft, but in response to stakeholders’ confusion on which lamp types require ambient life temperature testing versus elevated temperature life testing at 45°C or 55°C, EPA reformatted the supplemental testing guidance section and included bulleted lists to provide clarity on the applicability of ambient temperature and elevated temperature life testing.</p> <p>In response to stakeholders’ concerns that the specification does not provide a base-down elevated temperature life test option for directional lamps greater than 20W, and after confirming the possibility of a test chamber for the Option C test method that does not require personnel to enter a 55°C environment, EPA reinstated the Option C test method for elevated temperature life testing at 55°C.</p> <p>Although EPA believes that the restrictive product markings required for lamp safety certification, such as “not for use in enclosed fixtures” and “not for use in recessed luminaires” are intended to prevent consumers from installing lamps in incorrect luminaire types, the Agency is sensitive to concerns that manufacturers will begin labeling lamps with the restrictions to avoid life testing in an elevated temperature environment. EPA intends to track the availability of lamps suitable for use in enclosed and recessed fixtures, and in the future, may require all lamps to be tested in elevated temperatures and rated for use in recessed or enclosed fixtures.</p>

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<b>Lumen Maintenance</b>	<b>Ambient Temperature Life Test</b>	One stakeholder commented that the ambient temperature tolerance should be expanded from $\pm 5^{\circ}\text{C}$ to $\pm 10^{\circ}\text{C}$ to allow for fluctuations in outside temperature during the course of long-term testing and the difficulty associated with holding a tight temperature range.	In the final draft and aligning with IES LM-65-10, EPA increased the range for the ambient temperature during the ambient temperature life testing from $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ to $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ due to concerns from EPA-recognized laboratories citing the difficulty with holding the temperature testing environment stable over the course of a minimum of nine months.
	<b>Tolerances</b>	<p>In Draft 4 EPA removed the tolerance for lumen maintenance, and instead proposed an optional tolerance to be applied on initial luminous flux values of each unit, consistent with DOE regulations for medium base CFLs.</p> <p>One stakeholder commented that the optional tolerance on initial luminous flux values should be added also to the lumen maintenance section for clarification and consistency.</p>	In response to stakeholders request to extend the 3% tolerance allowed in the efficacy and light output requirement, and acknowledging the potential for measurement error in long-term testing, EPA updated the supplemental testing guidance allowing a 3% measurement tolerance that is applicable to the measured luminous flux values of each unit to be applied only if the calculated lumen maintenance value fails to meet the requirement without the tolerance. EPA believes that the application of tolerances to voluntary program specification requirements such as ENERGY STAR has the potential to inflate performance values and essentially de-rate the established requirement limits and/or levels across the board. Tolerances should be applied only in situations when the tolerance is needed on the measurement in order to comply with a requirement.
	<b>Early Initial Certification</b>	<p>One stakeholder commented that the 6,000 hours or approximately 9-month period of testing for the Lumen Maintenance testing for LED lamps is a major grievance for manufacturing stakeholders and encouraged EPA consider additional pathways to enable high quality products to enter the market sooner, including projecting lumen maintenance, accelerated and/or interim certification for “next-generation” LEDs or lamps with extended warranties.</p> <p>Several stakeholders commented that early initial certification process should be extended to CFLs at the 3000-hr mark as is allowed with LED lamps, citing this process will reduce qualified product availability risks. The stakeholder suggested lumen maintenance values ranging from 80 to 85% at 3000 hours.</p>	EPA is open to exploring faster pathways to certification that reduce testing time without compromising integrity and invites stakeholders to submit proposals for consideration for a future revision. EPA will continue to evaluate the proposal for earlier CFL certification for a future revision and requests that stakeholders supply further test data to support the proposal.

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<p><b>Luminous Intensity Distribution</b></p>		<p>One stakeholder commented that the proposed 90% sampling of measured values should be adjusted to 100% because the 10% of the measured intensity values that vary beyond 25% to a specified maximum of 50% may allow lamps with very non-uniform light distributions to be certified for ENERGY STAR. The same stakeholder also suggested that the use of “mean intensity” within 0°-135° degree zone is more accurate and a preferred definition, rather than a numerical average of data points on all vertical planes.</p> <p>Several stakeholders supported the flexibility of the proposed 90% sampling of measured values, but commented that the uniformity value of 20% is valid and should be reinstated from previous drafts.</p> <p>Another stakeholder commented that the solid-state industry has invested in conforming to the 20% uniformity requirement in the Integral LED Lamps specification, which surpasses the performance of incandescent lamps, and suggested that a relaxation to 25%, coupled with an allowance of 10% of measured values to vary up to 50% will allow the introduction of lamps that are inferior to commonly available LED omnidirectional lamps. The stakeholder requested adjusting the variation of 100% of the data points to be within 25% from the mean luminous intensity.</p> <p>One stakeholder requested an adjustment to the proposed specification, allowing 2% as a minimum requirement for zonal lumens in the 135°-180° zone.</p> <p>One stakeholder provided data for a different set of incandescent lamps which included double life lamps, and halogen lamps developed to meet new efficiency regulations, showing that these lamps present greater variation in light distribution and inconsistency throughout the measurement zones or planes. With this data a new approach was presented.</p>	<p>Like many of the performance requirements included in the Lamps specification, luminous intensity distribution is addressed in the interest of promoting a positive consumer experience with lamps that feature the ENERGY STAR label. EPA’s goal is to protect the consumer experience without presenting unnecessary obstacles to innovation and cost reduction. To that end, in response to comments from testing laboratories, that the intensity distribution data of some common incandescent A-lamps could not meet the current requirements for LED omnidirectional lamp performance, EPA performed additional research and analysis of A19 incandescent lamps and adjusted the allowed uniformity variance of the luminous intensity values for omnidirectional lamps to more closely align with the incandescent lamp data. These requirements, retained in this final draft, allow for greater flexibility compared to the existing specification for meeting omnidirectional requirements without compromise.</p> <p>While a range of substantive input was provided on this issue in response to Draft 4, none was sufficiently definitive for the Agency to adopt alternative acceptable omnidirectional requirements for general purpose LED lamp applications at this time. However, given its importance, EPA intends to extend its work on this issue, starting with the initiation of third party research. EPA invites stakeholders to remain engaged, as we explore omnidirectional performance evaluation approaches for further comment this fall for potential adoption as part of a near-term revision.</p> <p>While EPA believes that there is potentially an opportunity to update the performance requirements to allow for an even greater variety of acceptable and cost effective general purpose LED lamps to earn the ENERGY STAR, some concerns remain. There are still LED bulbs which look like they should replace general service incandescent bulbs that receive negative reviews from consumers based on light distribution. Reviews call out poor light delivery in certain areas that make some bulbs unsuitable for many applications they once used general service incandescent bulbs in.</p>

Topic	Subtopic	Comment	EPA Response
<b>Frequency</b>		One stakeholder commented that operating frequency of CFLs is not a critical parameter and the supplemental testing guidance for measuring operating frequency of CFLs will not provide an accurate measurement. The stakeholder also suggested that CFL manufacturers should be allowed to declare the operating frequency until a suitable test procedure is developed.	EPA removed the light output waveform guidance for CFLs, acknowledging that the proposed measurement guidance for frequency may not allow for the adequate capture of waveform data of high frequency compact fluorescent lamps. EPA will allow test labs and partners to determine the method by which to arrive at the reported frequency value for compact fluorescent lamps consistent with current practices for meeting the ENERGY STAR CFL specification.
<b>Power Factor</b>		<p>One stakeholder commented that the power factor requirement for CFLs should be increased from 0.5 to 0.7 to be consistent with the requirement for solid state lighting, noting that CFL manufacturers have the technology available and can design products to meet the higher power factor.</p> <p>Citing benefits of high power factor lamps, such as reducing the strain on natural resources and decreased cost to utilities, another stakeholder commented that it is time to move forward in the Lamps specification by raising power factor to a minimum of 0.75 across all technology categories.</p>	Consistent with EPA's goal to associate the label with products that are broadly comparable or societal interests, the Agency will retain the 0.5 power factor requirement for CFLs. EPA has not received strong support or data to justify an increase in power factor. If strong support from stakeholders is received, EPA may consider raising power factor for future revisions.
<b>Rapid Cycle Stress Test</b>		<p>In Draft 4, EPA updated the requirement, allowing CFLs with a start time of 100 milliseconds (ms) or less, a reduced cycling limit of once per every two hours of rated life.</p> <p>EPA received a comment that European Directive standards associate 300 milliseconds as the differentiation point between instant start and preheat (cathode) lamps and suggested EPA adopt the same differentiation point (300 msec.) for standardization purposes.</p> <p>One stakeholder provided data from cycling experiments suggesting that 2 minute cycles and 5 minute cycles may not be a one size fits all solution for all lamp types. The stakeholder provided a proposal for a new approach to cycling which includes determining the change in temperature, <math>\Delta T</math> and setting the cycle time based on the unique thermal resistance of the lamp.</p>	<p>While European Directive designates 300 ms as the differentiation point as it relates to cycling the directive does not indicate why or that it is a definition of instant start. EPA received the distinction of 100 ms as the definition of instant start from a manufacturing stakeholder that designs products for the U.S. market and has found references that define instant start as typically 100 ms or less, no greater than 200 ms.</p> <p>In response to the information received after draft 4, EPA will continue to explore alternative methods for switching and stressing LED lamps, and in the meantime, allow for cycling in 2 minute or 5 minute intervals. EPA invites stakeholders to provide data and proposals on this topic.</p>
<b>Run Up Time</b>		<p>In Draft 3, EPA increased the time allowed for covered CFLs to reach 80% stabilized light output from <math>\leq 90</math> seconds in Draft 2 to <math>\leq 120</math> seconds based on stakeholder comment.</p> <p>Several stakeholders commented that the proposed 120 second run-up limit for covered lamps is too restrictive, noting that run-up is a characteristic that suffers as a result of all the additional or tightened requirements in the specification, especially for covered products. The group suggested that a slightly longer run-up time will afford leeway in other areas, and requested a run-up time for covered lamps greater than 10 Watts of 150 seconds.</p>	After careful consideration and review of existing certified product data EPA confirmed that the proposed run up times are achievable for covered lamps, including high wattage covered lamps and lamps using amalgam technology and maintains the requirements from Draft 3 in the final draft.

Topic	Subtopic	Comment	EPA Response
<b>Scope</b>	<b>Excluded Products</b>	One stakeholder requested the inclusion of lamps incorporating power-consuming features, such as Wi-Fi, into the specification, citing the exceptions for luminaires incorporating these types of features in the existing Luminaires specification.	In preparation for future revisions to address lamps incorporating power-consuming features, EPA seeks research, data, or information characterizing the power usage of these products in the off state.
	<b>Non-Standard Lamps</b>	Stakeholders' comments continued to show support for excluding non-standards lamps.  One stakeholder claimed the non-standard SSL category would allow for innovative low-cost designs with higher efficacy values in the marketplace, noting there are many applications where providing a lamp with a shape that resembles incandescent lamps that does not meet the distribution characteristics of standard incandescent lamps is desired, evidenced by the sales numbers or such lamps.	Due to stakeholder concerns and confusion surrounding the non-standard SSL and semi-directional category introduced in Draft 2, the Agency maintains exclusion of these products from the scope in the final draft. After analysis of the current use of the non-standard SSL pathway, it is clear that it is not being used as intended, and is being used as a loophole for products that cannot meet performance requirements. Recent market surveillance indicates packaging requirements are not an adequate solution to the challenges posed by these products.
<b>Shape Dimensions</b>	One stakeholder commented that LED lamps, which are an emerging technology, should be afforded the greatest margin for variations in lamp shape dimensions and recommended the addition of a manufacturing tolerance to the ANSI dimensions applied (Min OAL, MOL and MOD).		EPA has included a 5% tolerance on the maximum overall length (MOL) for general purpose lamps, i.e., omnidirectional LED lamps. This was in response to a stakeholder comment suggesting that material and product variations are inherent to the manufacturing process, and after confirming that the ANSI standards acknowledge variations in lamp dimensions for an entire production run by allowing a percentage of lamps to fail the dimensional requirement. The tolerance was not extended to directional lamps since the dimensions of directional lamps are more critical to the luminaires design such as downlights and the lamp mounting apparatus of an accent luminaire.

Topic	Subtopic	Comment	EPA Response
<p><b>Technology Neutrality</b></p>		<p>A number of stakeholders commented that Draft 4 did not achieve technology neutrality because the specification includes testing and performance requirement differences that purportedly allow unfair advantages to some technologies. The stakeholders' cited non-standard CFLs, early initial certification, positive R<sub>9</sub>, rated life, and power factor as an examples.</p> <p>One stakeholder group highlighted the ENERGY STAR Product Program Strategic Vision and Guiding Principles and posed the question whether technology type is a decisive factor in a consumer's lamp selection in every case, select cases or only for particular applications. The stakeholder group requested clarity regarding EPA's rationale for applying one performance level across lamp technologies.</p>	<p>As presented in the Strategic Vision document, one of the ENERGY STAR Guiding Principles states that energy-efficiency can be achieved through one or more technologies such that qualifying models are broadly available and offered by more than one manufacturer. In line with this principle, EPA develops ENERGY STAR product specifications that identify the most efficient products available in the marketplace regardless of technology. An equally important guiding principle is that product performance is maintained with greater energy efficiency. Ensuring that product performance is not a trade off when consumers choose ENERGY STAR certified lamps may require in some cases the establishment of testing and performance requirements that may seem tailored to a given technology but support the goal of providing consumers with a positive experience with regards to other performance characteristics.</p> <p>In general, the ENERGY STAR program seeks to avoid picking technology winners and simply identify for consumers the most efficient product models that serve the desired purpose. In the case of lamps, applying uniform efficacy requirements across both technologies serves this objective, ensuring that ENERGY STAR represents the same level of energy savings across functionally comparable products. As LED bulbs become more dominant in the market, EPA expects to be able to increase efficacy requirements based on broader availability of higher performing models. At the same time, the Agency recognizes that preventing performance trade-offs may require the establishment of other performance requirements that are tailored to a given technology.</p>

Topic	Subtopic	Comment	EPA Response
<p><b>Toxics Reduction</b></p>		<p>In Drafts 1, 2, and 3, EPA included limits on mercury and other toxic material content in lamps. Mercury limits are different from RoHS requirements, some other toxic material requirements are consistent with RoHS, and after considering requests for exemptions and researching the applicability and alternatives, in Draft 4, EPA included additional exemptions consistent with the ENERGY STAR Luminaires V1.2 specification.</p>	
		<p>A number of stakeholders supported efforts in the specification to reduce mercury content, and also expressed confusion concerning references to the EU RoHS directive in the note box, believing the language inferred compliance with the directive. One stakeholder commented that the mercury content, in milligrams, should be disclosed on the lamp label as consumer information.</p>	
		<p>A stakeholder commented that mercury content limits should align with updates to a UNEP directive that are expected to be finalized June 2014.</p>	
		<p>One stakeholder commented that only US references for toxics substances should be referenced for ENERGY STAR, and also stated that the EPA ENERGY STAR program has exceeded its authority to institute toxic reduction requirements, noting a different office within EPA is responsible for toxic substance control matters, specifically the Office of Pollution Prevention and Toxics. Another stakeholder commented that other ENERGY STAR programs do not include toxics reduction as part of their specifications, and that other product sectors have pushed back on their introduction, and requested the removal of the requirements in the name of consistency and fairness.</p> <p>One stakeholder group commented that ENERGY STAR's approach for setting toxic reduction requirements in Draft 4 does not adhere to its long-held practice of referencing existing specifications, guidelines and standards, and noted that EPA has developed its own proposal, selectively pulling pieces from existing guidelines, including different lamp wattage bins than RoHS and NEMA. The stakeholder group also stated that mercury content levels in CFLs should be left up to industry, since it is an attribute with no energy efficiency correlation, and but is directly related to lamp performance. The same stakeholder requested the removal of toxics reduction requirements in the specification or the inclusion of the NEMA mercury commitment levels and their corresponding lamp wattage breaks.</p>	<p>As part of the 2012 update of the ENERGY STAR Strategic Vision and Guiding Principles, EPA clarified the program's objectives in addressing non energy attributes such as toxic substances. While energy efficiency remains the basis upon which top performers are selected to the extent that additional requirements are included, the Agency leverages existing standards and looks to achieve a minimally acceptable level of performance (i.e., not one that is overly stringent / difficult to achieve). By including additional attributes, the ENERGY STAR program seeks to avoid associating the label with models of poor quality or models with features that are not compatible with a consumer or societal interest specific to a product type, thereby preserving the influence of the label in the market. In setting requirements that are consistent with international best practices for toxics, (RoHS), EPA believes the levels in the draft are both reasonable in achieving our goals and not overly burdensome.</p> <p>With respect to mercury, the Agency developed requirements designed to strike a balance between meeting consumers' explicit desires for low mercury products, and requirements that were overly restrictive and difficult to achieve. Mercury in particular, given the ongoing level of concern among consumers and the media, is an area where ENERGY STAR products should offer nothing less than what is reasonably achievable.</p> <p>Lamp "bins" were selected for the purposes of the mercury requirement based on how lamps are made and sold in the USA, with most of the sales in the 23watt (1400-1600 lumens) and below bin. Including separate mercury content levels for the 24+ watt bin, covers the vast majority of lamps sold.</p> <p>EPA encourages manufacturers to disclose mercury content for CFLs but is not requiring it on the lamp or packaging at this time.</p>

Topic	Subtopic	Comment	EPA Response
<b>Verification Testing</b>		<p>One stakeholder commented that many of the additions in the specification have important implications for the Verification Program, and find the specification difficult to understand without reference to the Verification Program, and requested clarifications in the specification regarding how each criterion will be handled in the Verification Program.</p> <p>One stakeholder commented that the decision to a) not require dimming testing to be conducted at an EPA-recognized laboratory for Third Party Certification, and b) not be included as part of verification testing, sends a message to the industry that no one is watching, increases the temptation to game the system, provides an uneven playing field and disservice to manufacturers who have made investments to get dimming right. The stakeholder requested that EPA include dimming testing in the Verification Testing program.</p>	EPA will address verification testing for Lamps V1.0 with a directive.