

Lighting Research Center

To: Rich Karney – Department of Energy

From: Lighting Research Center

Date: January 24, 2003

Re: Comments on ENERGY STAR® Program Requirements for CFLs

Per the request of the Department of Energy, this memo is a submission of comments from the Lighting Research Center (LRC) concerning the 12/12/02 draft of ENERGY STAR® Program specifications for screw-based CFLs. The recommendations below include a general comment on sample-size and requirement evaluation for Photometric Performance Requirements and Electrical Performance Requirements and comments pertaining to the specification items for Correlated Color Temperature and Run-up Time.

Sample Size and Requirement Evaluation

Recommendation: The LRC recommends that the method on how a product meets the ENERGY STAR® requirement specification item should be consistent from item to item in the Photometric and Electrical Performance Requirements on page 5 and 6 of the 12/12/02 draft.

Justification: Within pages 5 and 6, there are three different methods used to determine if a specification item meets the requirements. For efficacy, "... the average of the lesser of the lumens per watt measured in the base-up and base-down positions" is used. For CRI, CCT and lumen maintenance, the average of 10 samples is used. Power Factor, Starting Time, Transient Protection, Operating Frequency and Electromagnetic Interference methods imply that if any lamp fails, the specification requirement is not met.

Recommendation: The LRC recommends averaging the base-up products separately from the base-down products and that both averages must meet the requirement.

Justification: Operating position can have an impact on efficacy, color, and many other requirements. Averaging all 10 could mask potential performance issues due to different operating positions. It is possible that the base-down positions could be below the specification, but when averaged with the base-up, the requirements are met and the base-down problems would be unknown.

Correlated Color Temperature (CCT)

The current proposed **ENERGY STAR**[®] requirement: “Average of 10 samples must be between 2700K and 3000K to market the CFL as warm, soft white equivalent. If not, packaging must clearly state temperature (in Kelvins) and corresponding color of product (cool white or warm white)”.

1. **Recommendation:** The LRC suggests that the range of acceptable CCT, 2700-3000K, be replaced with specific CCTs instead of the range. Products marketed as warm, soft white equivalent should be clearly labeled with the CCT of 2700K or 3000K on the package. Products with color temperature below 2700K or above 3000K should have the CCT clearly stated on the package along with “**warmer white**” or “**cooler white**” respectively.

Justification: In the range of 2700K to 3000K CCT, lamp color, although considered white, can be highly variable. Consumers can purchase lamps with the **ENERGY STAR**[®] logo, labeled “warm, soft white and still have unexpected variations in color. Although the ability to produce different colors can be a benefit of CFLs, unexpected variations in color reflects on the quality of the product and may prohibit the consumer from purchasing more lamps. Labeling the CCT on all products will help clarify the color differences to consumers, possibly decreasing consumer complaints about color issues. Changing the terms “cool white” and “warm white” to “cooler white” and “warmer white” is necessary to avoid confusion with established nomenclature with other light source types. Typically cool white is used to describe CCTs above 4000 K.

2. **Recommendation:** The chromaticity coordinates of the product must be within a 4-step MacAdam ellipse at the target CCT, a metric currently in use by the lighting industry to minimize product color variability. The coordinates for the center of the ellipse in 1931 chromaticity space are listed in the table below. The coordinates for 3000K and above are from ANSI C78.376-1996. No point for 2700K is specified so the LRC recommends placing the center of the ellipse for 2700K on the blackbody locus.

1931 Chromaticity Space		
Lamp CCT	x	y
2700K/ Soft white	0.46	0.411
3000K/ Warm white	0.440	0.403
3500K/White	0.411	0.393
4100K/4000K/Cool white	0.380	0.380
5000K	0.346	0.359
6500K/Daylight	0.313	0.337

Justification: Variations in color are viewed by consumers as a lack of quality. The chromaticity coordinates for the MacAdam ellipse in the ANSI C78.376 are very near, but not on the blackbody locus. The chromaticity coordinate specified for 2700K products is centered on the blackbody locus as a starting point. A more appropriate point may be chosen by working with the industry.

3. **Recommendation:** The LRC recommends that a specification item addressing CCT for Niche Application Colored CFLs be included in the requirements. The requirement should state that CCT does not apply to colored CFL products.

Justification: There is a specification item for “Color Rendering (CRI) for Niche Application and Colored CFLs”. In order to be consistent, there should be an item for CCT and niche applications. Since CCT is only applicable to products with chromaticity coordinates near the blackbody locus, CCT does not apply to colored lamps.

4. **Recommendation:** The LRC recommends that the Laboratory Requirement for CCT specify that the manufacturer “Must use a lab accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

Justification: The current proposal allows “Self-certification” for CCT evaluation. Color Rendering measurements require the use of a NVLAP accredited laboratory and CCT should as well. Self- certification is not acceptable on this critical measurement.

5. **Recommendation:** The LRC recommends that if there is a difference in CCT due to operating position, both values should be clearly marked on the package. Difference in CCT can be defined as the existence of the chromaticity coordinates for the base-down operating position lying outside the MacAdam ellipse centered around the average of the base-up chromaticity coordinates.

Justification: Operating position can have a significant affect on CCT, a difference that is noticeable and that should be noted on the product package. The MacAdam ellipse, by definition, distinguishes perceptible color differences.

Run-up Time

The current proposed specification: “≤ 3.00 minutes per ANSI C78.5 clause 3.11 and 4.8.”

ANSI C78.5 clause 3.11: “Run-up time: The time needed after switching on the supply for the lamp to reach 80% of its stabilized luminous flux.

ANSI C78.5 4.8: “Run-up time: The run-up time shall not exceed 3 minutes when tested at rated supply voltage in an ambient of 25°C.

Recommendation: The LRC recommends changing the statement to account for possible decreases in luminous flux below 80% after the 3 minutes. Run-up time should be defined as the time needed for the lamp to reach **and maintain at least** 80% of stabilized luminous flux.

Justification: Anecdotal evidence has shown that consumers have complained about noticeably different light outputs even after a few minutes of operation.

The LRC is currently conducting research on consumers concerns with CFLs and the barriers to using CFLs. Results of this work are intended to provide information for future **ENERGY STAR**[®] specification recommendations.