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GE Lumination
6180 Halle Drive
Valley View, Ohio 44125

GE Lumination Comments on Proposed Energy Star Requirements for SSL Replacement Lamps

GE Lumination is submitting the following comments in reference to the proposed Energy Star requirements for SSL replacement lamps released on January 16, 2009. GE Lumination appreciates the level of attention that the Department of Energy has spent on developing an attainable plan for energy efficiency products using LEDS and the ability to formally comment on the proposed SSL criteria.

The comments within this letter pertain to both the cover letter and proposed technical requirements.

Cover Letter Questions

Dimming

Is it possible to define a common protocol for LED products that would ensure acceptable dimming performance on most currently installed residential dimming controls?

At this current time it would be very difficult to develop a common protocol that would encompass all the different types of dimmers (phase control, ELV, reverse voltage, etc…) currently available in the market. The DOE's effort needs to be focused on driving the dimmer and LED lamp industry to go out and develop and understand what parameters are important for LED dimming and develop a testing procedure that verifies the LED lamp operation to a specific type of dimmer. Since a large amount of the dimmers are compatible with older technologies it will add cost and complexity to the LED lamps to be dimming compatible when looking at it from a macro level.

The DOE should understand that are many applications where dimming is not a needed option. The ability to dim is a very specific requirement only used in certain applications that can add cost and other technical hurdles to the lamp itself. The overall LED lamps described in this specification should be grouped into non-dimmable and dimmable.

Is it necessary to transition to new "LED-compatible" dimmers as more LED products come to market?

The easiest way for industry to move forward with LED dimming would be to develop an actual LED dimming specification, similar to what is seen in the fluorescent ballast world. This standard will allow the industry to standardize around important technical parameters. This step is necessary to ensure that 5-10 years down the road the industry doesn't end up at the same level of confusion regarding dimming types, what specification to use, and how to define compatibility.

How can DOE and the ENERGY STAR program best facilitate progress and improvement in the area of LED-dimmer compatibility?

The DOE should encourage NEMA, ANSI, NGLIA to drive the industry to come together and define standards for compatibility, as has been done in other areas, such as ballasts.

Non-Standard Replacement Lamps

Should luminous intensity distribution requirements be specified for non-standard lamps? Minimum luminous flux levels?

If these non-standard lamps are being marketed as a non-standard replacement lamps then specifying a minimum flux level is not needed. All lamps should have a defined beam angle or luminous distribution.

How can non-standard lamp performance be communicated to the buyer without creating false expectations? (For example even the statement of wattage equivalency -- "replaces 60-watt bulb" -- implies the lamp will look and perform like an A19 incandescent.)

The verbiage on the LED lamp's overall package should state that the LED lamp is a non-standard lamp and use the Lighting Facts label to define items like CRI, CCT, lumens, etc. The labeling or instructions for the lamp should not contain any information on how the LED lamp compares to current incumbent technology.

MR-16 Replacements

DOE seeks industry and stakeholder input on how to avoid problems potentially caused by installation of LED MR16 replacement lamps in existing low voltage lighting systems and not meeting minimum load requirements.

The DOE will want to promote the LED lamps but not inhibit the technology to work in current installations. The current installations use technologies that are not very energy efficient and are limiting in the type of products that can be used. If the LED lamp needs to have a minimum wattage it will defeat the purpose of energy saving lamps.

At a bare minimum the DOE should mandate that the labeling and instructions for the current LED lamp products should state the wattage of the lamp and any additional verbiage regarding compatibility.

Reliability

What kinds of requirements should be considered to minimize the likelihood of premature failure of ENERGY STAR qualified integral LED lamps?

A manufacturing technique that is normally used with electronic based products is called burn-in. Burn-in is the seasoning of the electronics for a short period of time at an elevated temperature (e.g. 4 hours at 35C) to "weed" out premature failures of internal components. This burn in procedure can be implemented by using predetermined APQP levels to ensure early reliability of the overall LED lamp supply. The sampling rate for burn-in reduces as the number of products passing through burn-in increases with the overall failure rate decreasing. The Final burn-in protocol should be facilitated by an organization like NEMA since it will affect manufacturing processes and overall delivery of the LED lamp.

What duration of testing is adequate to verify long-term performance?

The overall L50 lifetime for LEDs is usually in excess of 30K hours and as technology improves, that number will just become greater. The current technology available with respect to electronics allows for products like LED lamps to be commercially available. The testing procedure for understanding LED lifetime is defined by LM-80, with no mention of electronics. An effort should be started to develop an accelerated test method to investigate how to determine the overall life of the lamp based on the 2 major components of the LED lamp, the electronics and LEDs.

The testing of electronics is a mature topic in industry. DOE should encourage organizations like NEMA to develop an accelerated test and prediction specification that defines key factors like ambient temperature, number of samples, and confidence level. The development of this specification will allow LED lamp manufacturers to state electronic lifetime of LED lamps in the same manner and ensure that the products being produced are of the highest quality.

It is not acceptable to use an exponential model as a “one size fits all” approach to predicting lumen maintenance for a particular LED. The latest research has shown that there can be another 7 lumen maintenance behavior models possible. It is possible for an SSL lamp to have less than 80% lumen maintenance at 6,000 hrs and still meet the 70% lumen maintenance goal at 25000 hrs. It is GE Lumination’s belief that a classification approach for lumen maintenance would be a more amenable approach. The chart below shows the recommendations.

Luminous flux decrease at 6000 h as % of 0 h value	**Category Code**
Measured flux decreased by no more than 10% of initial flux	Cat A
Measured flux decreased by no more than 20% of initial flux	Cat B
Measured flux decreased by no more than 30% of initial flux	Cat C
Measured flux decreased by no more than 40% of initial flux	Cat D
Measured flux decreased by no more than 50% of initial flux	Cat E

The comments pertaining to the proposed to the technical requirements can be found in the following excel worksheet.

Technical_Requirements_SSL_Lamps.xls

Sincerely,

Jerry Duffy
VP of Technology
GE Lumination