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LED Lamps Sold at Retail Stores

Increasingly, LED lamps can be found on the shelves of retail stores nationwide, as they continue to gain traction with consumers. Two recent DOE CALiPER reports add key insights to our knowledge of how those lamps perform. The reports follow on the heels of CALiPER *Retail Lamps Study 3,* which was released last year and showed that LED lamps have quickly improved since they first came on the market, and now offer several advantages over their conventional counterparts. Most apparently, the LED lamps tested were found to offer substantially higher efficacies than conventional lamps, and usually provided sufficient light output—e.g., more than a dozen LED A19 lamps that were tested produced around 800 lm, roughly equivalent to a 60W incandescent lamp.

The first of the new reports, *Retail Lamps Study 3.1,* focuses on the dimming, power quality, and flicker characteristics of a subset of 14 LED A lamps from *Retail Lamps Study 3,* as controlled by four different retail-available dimmers. The results not only demonstrate that dimming with a phase-control device will change the performance of *any* type of lighting system, even when the dimmer is set to full output, but also show that the choice of dimmer can make a difference, and that the change in performance is less predictable when dimming LED lamps than when dimming incandescent lamps, with almost no change in some cases and dramatic changes in others.

Multiple LED lamps exhibited dimming curves that closely mimicked incandescent behavior; the flicker performance of several LED lamps was on par with incandescent; and one LED lamp maintained a power factor above 0.98 for the entirety of the dimming range. But there was no single LED lamp that was comparable to the benchmark incandescent sources across all performance characteristics, likely as a result of tradeoffs in performance (and cost) made during the design process. More broadly, LEDs generally provide specifiers looking to replace incandescent A lamps with a tradeoff of greatly improved efficacy—especially over the full dimming range—versus somewhat degraded performance in one or more photoelectric characteristics. But in many cases, the impact of that degraded performance may be negligible or acceptable, and the technology has been steadily improving in that regard.

Retail Lamps Study 3.2 focuses on lumen depreciation and color shift in a subset

of 15 LED A lamps from *Retail Lamps Study 3*. The lamps were monitored in an automated long-term test apparatus for more than 7,500 hours. On average, the lumen maintenance of the LED lamps was better than either of the benchmark (CFL and halogen) lamps, but there was considerable variation from lamp model to lamp model. In addition to three observed parametric failures (two from insufficient lumen maintenance and one from excessive color shift), almost half of the products failed to meet ENERGY STAR® early-life thresholds for lumen maintenance, which for seven products was sufficiently low at 6,000 hours that they were unlikely to have lumen maintenance above 70% at their rated lifetime (usually 25,000 hours).

Given the methods used for this investigation, the results should not be interpreted as indicative of a lamp's performance in a typical environment, nor should they be used to discredit manufacturer lifetime claims. A key takeaway is that the long-term performance of LED lamps can vary greatly from model to model, although the lamp-to-lamp consistency within a given model is relatively good. Further, operation of LED lamps in an enclosed luminaire (or other setting involving high ambient temperatures) can induce parametric failure of LEDs well before their rated lifetime, so manufacturer warnings about such conditions should be followed if performance degradation is unacceptable.

For more details on these instructive studies as well as others on LED retail lamps, see the full reports, which are available on the DOE website.

As always, if you have questions or comments, you can reach us at postings@akoyaonline.com.