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Certifying Luminaires: LED Light Engines and GU24-Base Lamps

Replaceable LED light engines, and GU24-base LED lamps provide a great opportunity for flexibility for energy efficient luminaires. Using these products in lieu of built in LED systems can help reduce engineering costs, testing costs, and reduce landfill waste in the future. ENERGY STAR's latest specification Luminaires V1.1 provides a simple pathway for qualifying fixtures with these products.

For purposes of qualifying an ENERGY STAR luminaire, an LED light engine is defined in the specification as an integrated assembly comprised of LED packages (components) or LED arrays (modules), LED driver, and other optical, thermal, mechanical and electrical components. A GU24-base LED lamp is similar, but has an ANSI standard base and is likely to be found in more traditional lamp formats.

In either form, these devices contain everything necessary to take line voltage and generate LED light, and the products can be tested independently of the light fixture by the manufacturer of the light engine or GU24-base LED lamp. Qualifying a luminaire using an LED light engine or GU24-base LED lamp that has already been tested at an EPA-recognized laboratory is similar to qualifying a luminaire that would use a traditional fluorescent lamp and ballast. EPA has developed a database for subcomponents whose test data has been certified by an EPA-recognized certification body for the use in ENERGY STAR qualified luminaires. This new database has replaced the NEMA/ALA matrix of lamps and ballasts and platforms previously used for ENERGY STAR.

Benefits of using LED Light Engines and GU24-Based Lamps

Reduced Engineering Costs and Speed to Market - with LED light engines and GU24-base LED lamps most of the engineering is already done. The driver, optic, LED(s) and heat sink are ready to go, reducing the time the luminaire is in development.

- Using LED light engines or GU24-base lamps that are listed on the Certified Lighting Subcomponent Database (CSD) can further simplify the steps necessary to certify a luminaire. The only test required for non-directional luminaires is an in situ thermal test, often referred to as the "heat test" or "thermal test". A directional luminaire will still have to be tested using luminaire photometry, just like a fluorescent directional luminaire would.

Example: To qualify a decorative pendant, which is classified as a non-directional luminaire, using an integral LED light engine from the CSD would only require:

ENERGY STAR Testing of:
In-situ thermal test of the LED light engine
In-situ thermal test of the LEDs themselves (to determine lifetime)
Off-state power consumption (if there is an internal method of switching)
Driver case temperature

ENERGY STAR Verification of:
Light Source Replaceability
Light Source Shipment
Safety Listing
Labeling & Packaging

Line Flexibility - a different light engine or lamp is all that is required to add CCTs, beam angles, allowing more options for end users.

(please see next page)

Use of replaceable components provides several additional benefits:

- **Reduced Repair Costs** - in the unlikely event of a problem in the light engine in the field, the entire luminaire does not have to be removed, only the light engine, reducing labor costs and environmental waste.
- **Reduced Inventory Costs** – using replaceable light engines or lamps in multiple luminaire variations within a family, economies of scale can be leveraged for source costs, and it is possible to maintain high service levels on a wider range of products with lower inventories of LED components.
- **Upgradeable Luminaires** - as technology improves over time, new light engines or GU24-base lamps can be upgraded and swapped out with minimal additional testing to improve the light output, efficacy or cost-effectiveness of the luminaire.

Qualifying LED Light Engines and GU24 Based LED Lamps to the CSD

For an LED light engine or GU24-base LED lamp to be listed on the CSD, the following information must be obtained through testing by an EPA-recognized laboratory to qualify non-directional SSL luminaires and provided to an EPA-recognized certification body:

- Luminous Efficacy
- Lumen Output
- Lumen Maintenance (through TM-21 or testing)
- Correlated Color Temperature (Indoor and Indoor/Outdoor only)
- Color Rendering (Indoor and Indoor/Outdoor only)
- Color Maintenance (Indoor and Indoor/Outdoor only)
- Maximum In-Situ Operating Temperature at T_b to meet ENERGY STAR specifications based on LM-82-12 results
- Source Start Time (Indoor and Indoor/Outdoor only)
- Source Run-Up Time (Indoor and Indoor/Outdoor only)
- Dimming (as applicable)
- Power Factor
- Transient Protection
- Operating Frequency
- Maximum Recommended Driver Case Temperature
- Temperature Measurement Point on the Driver Case (TMPd)
- Minimum Operating Temperature (Outdoor and Indoor/Outdoor only)
- Driver Safety

If you have any other questions about product qualification with LED light engines or GU24-base product, or if you need additional clarification, please contact the ENERGY STAR program at any time at luminaires@energystar.gov.