Engineered for Quality & Reliability
Lunera Linear LED Lamp Family

LUNERA® LABS

Application Note

Breakthrough Engineering

Lunera's Linear LED Lamp family is engineered for quality and reliability. They deliver the expected, general benefits of an LED lamp (Table 1), but also have engineering breakthroughs incorporated that enhance the performance, quality, and reliability of the products (Table 2). This application note introduces the breakthroughs in the electronics package, the LEDs, and the tube material.

Table 1. General LED Benefits

Significant Energy Savings
50,000+ Long Life
Maintenance Free Operation
Near Full-Spectrum Quality Light

Figure 1. Lunera LED Linear Lamps

(Left to Right) 4Ft T8; 4Ft T5HO; 2Ft T8

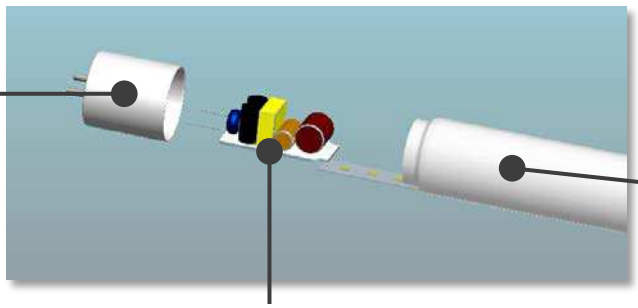
Table 2. Engineered Breakthroughs

Flexible LED PCB & Driver Electronics
LED Selection
Glass Tube Construction

Breakthrough 1: Electronics

Customer satisfaction is frequently derived from elements of a product that aren't seen. Often, a failure in design can lead to performance problems that negatively impact the customer experience. In Lunera's family of linear LED lamps, the innovation in the electrical circuitry and components aren't seen, but they represent a key aspect of our product's premium performance.

Figure 2. Linear Lamp Electronics Package



Engineered for Quality & Reliability

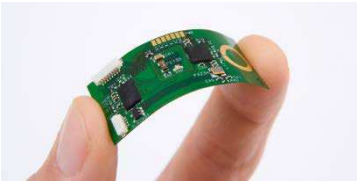
The electronics of Lunera's linear LED lamps are designed for superior performance, quality, and reliability.

Driver Circuitry
Lunera invented plug and play LEDs for commercial lighting, launching our first ballast-driven products in 2013.

One of the greatest sources of customer frustration with ballast-driven LED lamps is poor ballast compatibility. Lunera invented the plug and play lamp category and leads the industry in compatibility. Lunera's linear LED lamps have been tested for compatibility in over 200 ballasts and are compatible with Instant-Start, Rapid-Start, and Programmed-Start ballasts.

Furthermore, the compact design of the electronics package helps to minimize the end cap size and maximize the illuminated area of the tube.

Flexible PCB Assembly
Switching from a rigid to a flexible PCB, eases soldering stress, improves thermal conduction to the glass, makes the lamp lighter, and enhances safety in the event of glass breakage.



Breakthrough 2: LEDs

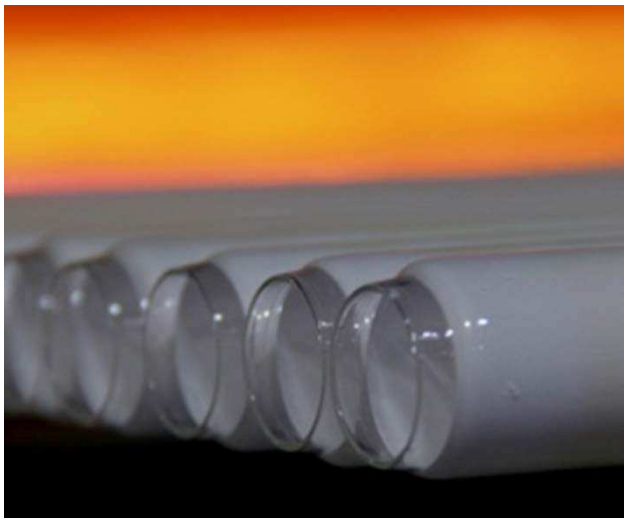
Selection
Lunera uses high-performance LED chips which are enclosed in a robust package and finished with a top-quality phosphor to ensure a long life with exceptional performance.

Throttle Back the Driver
Excess heat can damage LEDs. Using an optimized thermal design, we keep the LEDs in the Lunera linear LED lamps running reliably by intentionally operating them at less than 40% of their rated drive current. This keeps the LED's unction temperature low, which improves efficacy and extends the lamp lifetime.

Breakthrough 3: Glass Tube

Better Glass

Lunera's linear LED lamps are constructed of premium glass tubes coated using a proprietary diffusion technology that does not age, yellow, or crack and delivers superior optical efficacy and outstanding lumen maintenance.



Our glass tubes do not bend. The manufacturing process toughens the glass and includes "end necking" and "sealed end caps", to strengthen the overall design and resist breakage.

Lunera's glass tubes is dramatically better than plastic alternatives as shown in Table 3.

Table 3. Lunera Glass Compared to Plastic LED Tubes

	Lunera Glass	Plastic
Perception	Classic design, valuable	Plain, cheap
Performance		
Optical Efficacy	92%	88%
Lumen Maintenance	Lasting	Degrades
Thermal Management	Thinner , high melting temperature	Thicker, lower melting temperature
Safety & Reliability		
Flammability/Arcing	No	Yes
Bending	No	Yes
Yellowing	No	Yes
Cracking	No	Yes

Table 4. Lunera Glass Compared to Other LED or Fluorescent Glass Tubes

	Lunera Glass	Other Glass
Material	Fine white pure sand	Sands with other elements/chemicals
Processing		
Glass Furnace	Electric – high precision control	Coal/Gas – Instable process control
End Necking (end form)	Yes – strengthens the end, which is the weak point	No
Toughening	Yes	No
Capping	High strength seal	Low strength glue
Coating	Proprietary diffusion that does not yellow, age, or crack	May yellow, age, or crack in 2-3 years

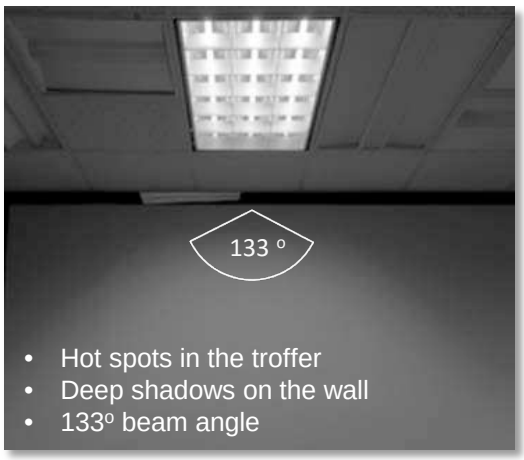
330 Degrees of Uniform Light Distribution

The optics of the tube plays a key role in how closely the LED linear lamp matches the appearance of the fluorescent lamp it is replacing.

We've optimized the optical design for a beam angle of ~330º which makes the light output as close to fluorescent as possible, perfectly fitting existing fixtures and delivering uniform light across space.

Figure 3. Lunera Glass v. Plastic

Plastic Tube



Lunera Glass