

LEDs and Emergency Lighting

Part 1: New Solutions for New Technologies



Content Highlights

- Integral Battery Packs and Unit Inverters are two solutions for LED applications
- Integral Battery Packs provide a value-added option for manufacturer fixture designs
- UL Requirements for LED battery packs differ from other emergency battery pack options
- Unit Inverters are powerful solutions for field installation or retrofit applications
- Inverters require proper sizing for accommodating LED loads

Light emitting diode (LED) technology is creating significant changes in the lighting marketplace. LEDs present several advantages over incandescent or fluorescent lamps for lighting designers and end users. The small compact size of LEDs can offer architects more lighting placement options and can be more visually appealing than larger fluorescent lighting fixtures. The longevity of LEDs is an advantage to end-users. According to the Department of Energy's Office of Energy Efficiency and Renewable Energy, "good-quality white LEDs in well-designed fixtures are expected to have a useful life of 30,000 to 50,000 hours or even longer. A typical incandescent lamp lasts about 1,000 hours; a comparable CFL lasts 8,000 to 10,000 hours, and the best linear fluorescent lamps can last more than 30,000 hours."¹ With a useful life for some LED types extending to 70,000 hours and beyond, LEDs easily outpace other lamp types for longevity. LEDs also require less watts to produce the equivalent amount of light output (lumen) as incandescent or fluorescent lights, thus saving end-users money on their electric bill.

LED Fixtures for Emergency Lighting

Even as lighting technologies change, emergency lighting requirements still remain. In the United States emergency lighting system specifications for illuminating the path of egress in commercial and public spaces are set forth by the Life Safety Code, National Electric Code (NEC), and the International Building Code (IBC), which define the duration and illumination level to be provided. Several methods are available to achieve the emergency lighting requirements, such as using dedicated wall-mounted fixtures, however a popular and less obtrusive choice has always been to use the existing fixtures

¹Department of Energy, Office of Energy Efficiency. "Solid-State Lighting, LED Basics, How long do LEDs last?" http://www1.eere.energy.gov/buildings/ssl/sslbasics_ledbasics.html#how_efficient. See http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/life-reliability_fact-sheet.pdf for more information on LED lifetime & reliability

Figure 1: UL Marks (Listed and Component Recognized) - UL is a safety science company which independently certifies, validates, tests, inspects and audits products and companies' processes on a global basis. The primary difference between UL Listed and UL Recognized is that a UL Listed product is an end product or a complete component that can be installed in the factory and in the field. A UL Recognized component is one that will be installed within another product at the factory only.



to supply the emergency lighting. LEDs are a good solution for emergency lighting because of their longevity and low watt usage. An emergency lighting system can use the existing LED fixtures by utilizing an integral auxiliary battery pack or remote-mounted unit inverter system as the emergency power source. When normal AC power is lost the emergency battery pack or inverter switches on and operates the fixture(s) for the required duration.

The Integral Battery Pack Solution

Integral battery packs for LED fixtures are a popular solution for emergency requirements for many reasons. The presence of an emergency function in an existing fixture brings additional value to the manufacturer's design by allowing specifiers and planners to easily incorporate code-required emergency lighting in their fixture schedules with minimal effort. Designers and architects also enjoy the benefit of avoiding the use of unattractive wall-mount equipment in their interior spaces. Additionally, emergency-equipped fixtures provide an increased level of control by enabling the designers to properly place the needed illumination along the entire paths of egress.

UL Component Recognition

A battery pack must meet the Underwriters Laboratories (UL) 924 standard in order to be acceptable for emergency lighting use. Whereas output voltage was not a concern for meeting UL requirements when operating fluorescent lamps from a battery pack, LED arrays require a more careful approach to ensure proper operation. Because many LED lighting fixtures have a custom LED driver, which is comprised of a power source and control circuitry designed to operate the LED array with a specific forward voltage, the emergency battery pack must be evaluated within the entire fixture design to verify proper performance within the system and compliance with UL 924. This includes evaluating the minimum light output performance at the luminaire level. LED battery packs that require this procedure bear the UL Component Recognized mark (see **Figure 1**).

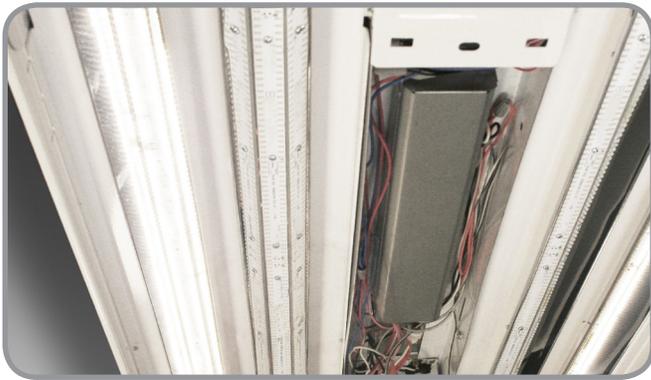


Figure 2: Integral LED Battery Packs install within, atop, or next to the LED fixture to provide emergency power. In this photo, a battery pack installs within the troffer to power the LED strips.

At present time, a condition of acceptability for UL Component Recognized emergency battery packs is that they be factory-installed, therefore these particular types of battery packs are not available for contractor installation or for retrofitting an existing LED fixture and instead are purchased as part of the entire fixture. IOTA offers several integral battery pack options designed specifically for OEM LED fixture products. These battery packs

and their design features are detailed in Part 2 of this article "**Integral Battery Pack Designs and Performance.**"

Inverter Solutions for LED Field-Install and Retrofit Applications

Contractors and facility managers who wish to use existing LED fixtures to meet their emergency lighting requirements are not completely restricted by limitations posed by UL battery pack requirements. Many of the LED install and retrofit applications are fulfilled through the use of unit inverter equipment. Unit inverter

systems are typically installed in a maintenance or utility room and will deliver AC power to fixtures on the dedicated circuit from the inverter's battery supply during a power loss.

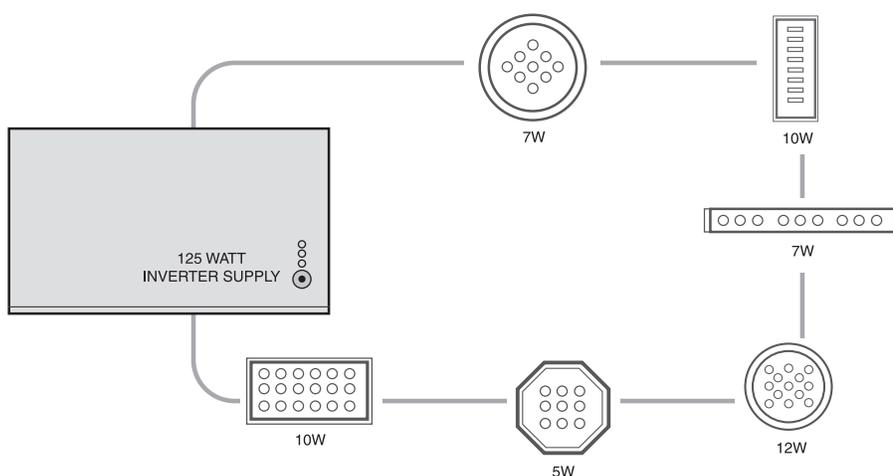
In addition to the fact that inverter systems can be installed or retrofitted on-site, there are several other advantages of using an emergency inverter for LED loads. First, the inverter supplies AC power to the fixture and allows the individual LED driver to operate the array as it was designed to, rather than switching the array to a secondary battery pack. This means the inverter can operate several LED fixtures, despite the varying electrical requirements often present in custom LED designs (*Illustration 1*). Second, the lower power requirement of LED fixtures means a single large inverter supply can operate several LED fixtures for the required duration. Third, inverters allow the LED fixture to operate at full light output whereas an integral battery pack most likely will operate the LED fixture at a lower wattage (ie. lower light level) to accommodate the smaller battery capacity. The fourth advantage is the inverter's ability to deliver line voltage to the LED fixtures up to distances of 1000 feet, meaning an inverter installed indoors can still operate exterior fixtures for outdoor egress requirements. Integral battery packs for outdoor LED applications do exist but require specialized thermal protection features to ensure proper operation and compliance with the Life Safety Code, NEC, and IBC.

LED In-Rush Awareness

Inverter solutions for LED applications must take into account LED inrush current when sizing the inverter to the load. LED drivers often draw an initial 'surge,' or inrush, of power for operating the array. Depending on the number of LED fixtures on the load, their various inrush demands, and the load capacity of the emergency inverter, this initial load requirement could potentially exceed the inverter specifications, causing premature shut-down of the system. Installers of inverters can determine system size by using the inrush specifications as the maximum load requirements of the circuit.

Making Your Lighting a Success

Through careful consideration and understanding of the available emergency LED lighting options, designers, specifiers, contractors and facility managers can enjoy the energy-efficiency and modern appeal of LED lighting while still



Life Safety Code®

The Life Safety Code requires a specified level of emergency illumination, regardless of lamp and fixture type. Section 7.9.2.1 of the Code states "Emergency illumination shall be provided for not less than 1 1/2 hours in the event of failure of normal lighting. Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 10.8 lux (1 ft-candle) and, at any point, not less than 1.1 lux (0.1 ft-candle), measured along the path of egress at floor level. Illumination levels shall be permitted to decline to not less than an average of 6.5 lux (0.6 ft-candle) and, at any point, not less than 6.5 lux (0.06 ft-candle) at the end of the 1 1/2 hours. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded."

Illustration 1: Inverters Operating an LED Load

Because an inverter supplies AC power to the entire circuit, it will operate multiple LED fixtures regardless of varying voltage and wattage specifications of the arrays.

The IIS-375-LED Inverter



IOTA's IIS-375-LED inverter was designed specifically for LED applications. The IIS-375-LED provides 375W of emergency power and features an increased in-rush capacity for LED loads with harsh inrush demands. For more information regarding the IIS-375-LED, visit www.iotaengineering.com/iis375led.htm

providing the proper emergency performance that the Life Safety Code demands. For further details on the functions and capabilities of integral emergency battery packs, read Part 2 of this article "**Integral Battery Pack Designs and Performance.**" For questions or comments, you may contact IOTA at 1-800-866-4682 or visit us on-line at www.iotaengineering.com.

About IOTA Engineering

IOTA is a privately held, family-owned company that has worked continuously in the electronic R & D field, designing and manufacturing innovative products for the lighting and electronics industries since 1968. Initially focused on the development of low voltage solid state ballasts, IOTA has expanded to include emergency battery packs for contemporary lighting designs, DC inverter ballasts, and AC/DC power converters and battery chargers. The company is a leader in developing emergency battery pack designs that meet unique customer specifications. IOTA is continually expanding its development of state-of-the-art electronics that keep pace with customer needs and industry demands. From the circuit board design to the completed unit, IOTA designs and develops products that maintain superior performance, and is dedicated to providing the highest levels in customer satisfaction, quality and innovation in the industry.

