

ENLIGHTEN AND INSPIRE

Energy Focus Safety

Leading and Inspiring



Table of Contents

3	Overview
4	Single-Ended Direct Wire Design
6	UL Safety Standards
7	FCC Regulations for Lower Emissions
8	Inrush Current Avoidance
10	Low Operating Temperatures
12	Best Practices
13	Being A Responsible Buyer
15	About Energy Focus





Overview

Energy Focus is committed to remaining a leader in the industry and providing safe, efficient and effective products. As a leader, it is our responsibility to educate the world on why certain methods are safe and others can pose a hazard. While we are not speaking for our competitors, we are speaking for the technology, as we truly care for our partners and customers and hope to maintain our integrity in creating safe products.

With intent, Energy Focus designed and created the safest LED lighting products possible. Other manufacturers insist on using cheap materials, sourcing without testing, and practicing methods that lead to hazards for the end-user, essentially “cutting corners” which reflects poorly on the entire LED industry.



Single-Ended Direct-Wire Design

Overview

It is important to note that for Direct-Wire lamps, (and Dual-Mode lamps in Direct-Wire mode) with single-ended power provides an inherent safety precaution to avoid potential for electric shock or other hazards, as one end has no electrical activity.

Detail

Legacy fluorescent fixtures require an external ballast to regulate the power to the lamp. TLEDs similarly require a driver, but allow for more creative solutions to the location, size and connections of its driver due to the convenience of LED chips on a solid surface. The driver of a TLED can be located within the tube (Integral Driver) or outside of the tube (Remote or External Driver, Type C), similar to a ballast. Integral driver TLEDs can operate as:

- Type A: “Plug and Play” or “Direct-Fit” with an integral converter to operate on an existing electronic fluorescent ballast
- Type B: “Direct Wire” directly wired to the electrical mains bypassing the fluorescent ballast
- Type A/B: “Dual Mode” such as the Energy Focus Intellitube that may operate as either (direct-fit or direct wire mode).

Each type of TLED is analyzed for its potential safety issues or benefits on the right.

Type A

Direct-Fit

- While they can result in around 30% energy savings without having to hire an electrician or exposing building infrastructure, Type A lamps are a temporary solution as they rely on the life of the ballast to operate. Fluorescent ballasts last less than half as long as high-quality LED tubes, necessitating replacement of a legacy technology to keep TLEDs operational. Additionally, ballasts draw a small amount of current, diminishing energy savings.
 - There are no safety standards regulating the compatibility of TLEDs with ballasts, which can lead to destruction of the lamp and risk of electrical shock and fire if incompatible.
-

Type B

Direct-Wire

Energy Focus

D-Series

- The straightforward approach of an internal driver directly wired to the electrical mains ensures clarity in installation and interoperability, as this is the method used for screw-in bulbs as well as a variety of non-lighting electronic devices. UL certifies Type B lamps just as any other electronic appliance and includes all of the safety features necessary to protect the end-user, allowing for cohesive compliance.
 - Type B TLEDs result in maximum energy savings and sustainability. Future innovations in LED lighting lead to the phasing out of fluorescent ballasts and connected systems that are most interoperable with Type B lamps.
 - With single-ended power design, only one end has any electrical activity while the other end is completely dead and functions only as structural support.
 - Tombstones should always be replaced with new, non-shunted lampholder sockets when re-wiring the fixture.
-

Type A/B

Dual-Mode

Energy Focus

Intellitube

- Dual-mode TLEDs provide the ease of retrofitting without having to hire an electrician upfront and gaining substantial energy and maintenance savings. However, when the fluorescent ballast inevitably dies, you are no longer dependent on replacing it. You can re-wire your fixture and upgrade your energy savings with the same TLED in single-ended direct-wire mode.
 - Energy Focus tests the Intellitube products with every electronic ballast we encounter, updating this list regularly. We track which ballasts we are compatible with, and only use the Intellitube with those ballasts. A customer who has purchased Direct-Fit TLEDs may find some different ballasts throughout their building during the retrofit process. The Intellitube provides a safeguard for such a situation by allowing the customer to direct-wire those fixtures and use the same TLEDs they have already purchased.
-

Type C

External Driver

- External drivers represent a high level of unnecessary risk to safety. Although the tube and driver are exclusively paired at the time of installation, these systems are rarely made fail-safe. If even one LED chip in one tube fails, the other tubes become over-driven, increasing their heat, decreasing their lifetime and creating a severe risk of fire.
- Finding a proper replacement lamp or driver is no simple matter: many manufacturers do not offer replacement parts. Pairing the wrong lamp with the wrong external driver or mixing incompatible lamps can lead to overloading components, introducing the risk of fire. These hazards do not come with any increased convenience in installation as installing both the external driver and tube is more time-consuming than a simple direct-wire retrofit, yet still requires an electrician on site since the ballast must be bypassed and the external driver must be added into the system.



UL Safety Standards

Overview

Underwriters Laboratory (UL), a global, independent safety science company that certifies designs submitted by manufacturers, authorizes that a lighting fixture's original certification will not be voided from a Direct-Wire (Type B) retrofit - rather, it is augmented by the retrofit so long as the end-user follows safety protocols when wiring their fixture.

1. Underwriters Laboratory. "What You Should Know About UL Certified Retrofit Kits" <http://industries.ul.com/wp-content/uploads/sites/2/2013/09/Certified-Retrofit-Kits-What-you-should-know.pdf> September 2016.
2. Underwriters Laboratory. "Luminaire Ballast Retrofits and Conversions: How does that affect the luminaire listing?" http://www.ul.com/wp-content/uploads/2014/04/ul_LuminaireRetrofits.pdf September 2010.
3. Underwriters Laboratory. Online Certifications Directory: Energy Focus. <http://database.ul.com/cgi-bin/XYV/cgifind/LISEXT/1FRAME/srchres.html>

Detail

A manufacturer obtains UL approval on their TLED product. Users must follow guidelines to maintain their UL certification. New, non-shunted lampholders must be installed, proper installation procedures as given by the manufacturer must be followed and a new label must be displayed clearly in the fixture indicating that it has been re-wired to warn against using any other kind of lamp in the fixture.

UL states that these requirements apply to "retrofit kits consisting of light-emitting-diodes (LED) light sources intended to replace a fluorescent lamp where it is necessary to modify the luminaire. The modification involves removing the fluorescent lamp ballast and rewiring lampholders within the luminaire in order to power the LED light source or removing the fluorescent ballast and installing an LED driver (power supply) and rewiring the lampholders. A luminaire that is modified so it can no longer accept the original lamp has a label affixed (provided by the retrofit kit manufacturer) indicating the luminaire has been modified and can no longer operate the originally intended lamp(s)."



FCC Regulations for Lower Emissions

Overview

Type B lamps are held to a higher standard of FCC regulations, resulting in an overall higher quality product.

Detail

The Federal Communications Commission (FCC) regulates interstate and international communications by radio, television, wire, satellite and cable. Any type of interference in these communications can result in malfunction in equipment. For example, in hospitals, lives depend on electronic devices, and interference can pose a significant hazard. Lighting can introduce unintentional electromagnetic interference if not properly fitted, and so lighting manufacturers must comply with the FCC. Type A lamps need only comply with the standards for fluorescent lighting, which allow for more interference to be produced. Type B lamps have an additional standard they must comply with which is more aggressive. As a result, Type B lamps will provide less electromagnetic interference, an added safety benefit.



Inrush Current Avoidance

Overview

Energy Focus avoids issues with inrush current with front-end capacitance to effectively handle diverse power conditions. Our superior driver engineering allows us to avoid current overload when power is first supplied to the lamp. Other products will be destroyed from the natural inrush of current that is provided. Energy Focus products use “soft-start” technology, while the front-end capacitors absorb and store excess energy and ensure optimal operation.

Detail

LEDs are characteristically direct current (DC) devices, meaning they require drivers that convert the line voltage (100-277V) power to the DC needed to properly power the LEDs. While this technology is similar to, for example, computer power supplies, lighting can simultaneously turn on large loads with literally the flip of a switch.

In some electrical equipment, a power consumption may be briefly higher at turn-on than during regular operation. This “inrush current” can be many times greater than the rated load current, which is dangerous if it exceeds the rated current of electrical wiring. In lighting, inrush current can be caused by many factors, here are a few examples:

- Technology with filaments or heating cathodes, such as incandescent electronic and magnetically ballasted fluorescent and arc lamps, draw higher current at startup until the filament is heated.
- Technology with electronic drivers, such as LEDs, may have integrated components like capacitors that can draw higher current while the capacitors are being charged.



Nearly all LED lights use capacitors to store charge for a variety of functions in the driver, which can lead to inrush current depending on how the driver is designed. In particular, capacitors that are at the input of the driver will cause inrush, larger capacitors having greater inrush. In these lamps, the capacitors charge as fast as mains voltage will allow, which is very fast. Even if inrush is not specified be aware that lamps with Total Harmonic Distortion (THD) >50% and Power Factor (PF) <0.85 are likely designed this way. Drivers with high PF do not have bulk capacitors at the input, which creates the opportunity to control inrush but does not guarantee it. Drivers using techniques known as “soft-start” slow the charging of these capacitors and eliminate inrush current. Drivers that do not soft-start may still have substantial inrush, particularly if they have “instant-on” response.

An LED driver must limit the input current during startup to ensure that current never exceeds steady-state values. Using soft-start techniques is one method of this, such that capacitors are charged with a controlled current. Energy Focus self-certifies compliance with NEMA 410, “Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts” on all direct-wire lamps to ensure optimal operation. We use high power factor (>0.9) front-end controllers with soft-start technology that guarantees power delivered to the load is ramped from zero to maximum in a controlled, safe manner.

Low Operating Temperatures

Aluminum Backbone

Overview

Temperature and safety are strongly related. By ensuring low temperatures, safety hazards can be avoided in TLED products. Energy Focus uses a D-channel aluminum extrusion in contact with heat generating components for superior thermal dissipation. The aluminum backbone also provides sturdy structural support that will not bend, break, melt or bow.

Detail

Several LED lighting manufacturers have had to recall products due to “overheating and melting, posing a burn hazard.” The products recalled were composed entirely of plastic, which is a poor heat sink and would have allowed for the absorption of the heat provided by the LEDs and driver.

Aluminum is a light material, allowing for reduced stress on the lampholders but still dissipating heat safely.

Direct-Wire TLEDs offer an additional safety benefit over Direct-Fit. Fluorescent ballasts that draw current generate heat in the fixture, resulting in overall higher temperatures. By bypassing the ballast and operating the TLED driver in conjunction with an Aluminum backbone, lower temperatures are guaranteed.

Component Quality

Overview

Another method for regulating TLED temperatures is choosing high-quality components. Cheaper electrical components are not worth the risk they pose. Using superior components results in safer operating conditions, longer product life and the lowest total cost of ownership.

Detail

Energy Focus knows that total cost of ownership holds more value than low initial costs. Products that last longer allow end-users to reap energy savings without having to continually replace their lights. That’s why we only use the highest caliber components in our drivers. Our combined efforts of electrical design with our Aluminum backbone allow our products to operate at cooler temperatures, which not only provides added safety, but also lengthens the life of the components.



VAN DORN 120

HT SERIES

Cutter

Working

Best Practices

Consult an Electrician

We spend 90% of our time indoors, and artificial lighting has become a commodity we are comfortable using. Many of us change our own light bulbs at home. However, when doing a retrofit in a building, especially when any wiring is required, it is crucial to consult a certified electrician.

No Hot Swapping (Intellitube or Direct-Wire)

Hot-swapping LED lighting products creates current spikes that can destroy any LED. The safest method of installing lighting products is to **ALWAYS TURN OFF THE POWER BEFORE STARTING YOUR RETROFIT.**

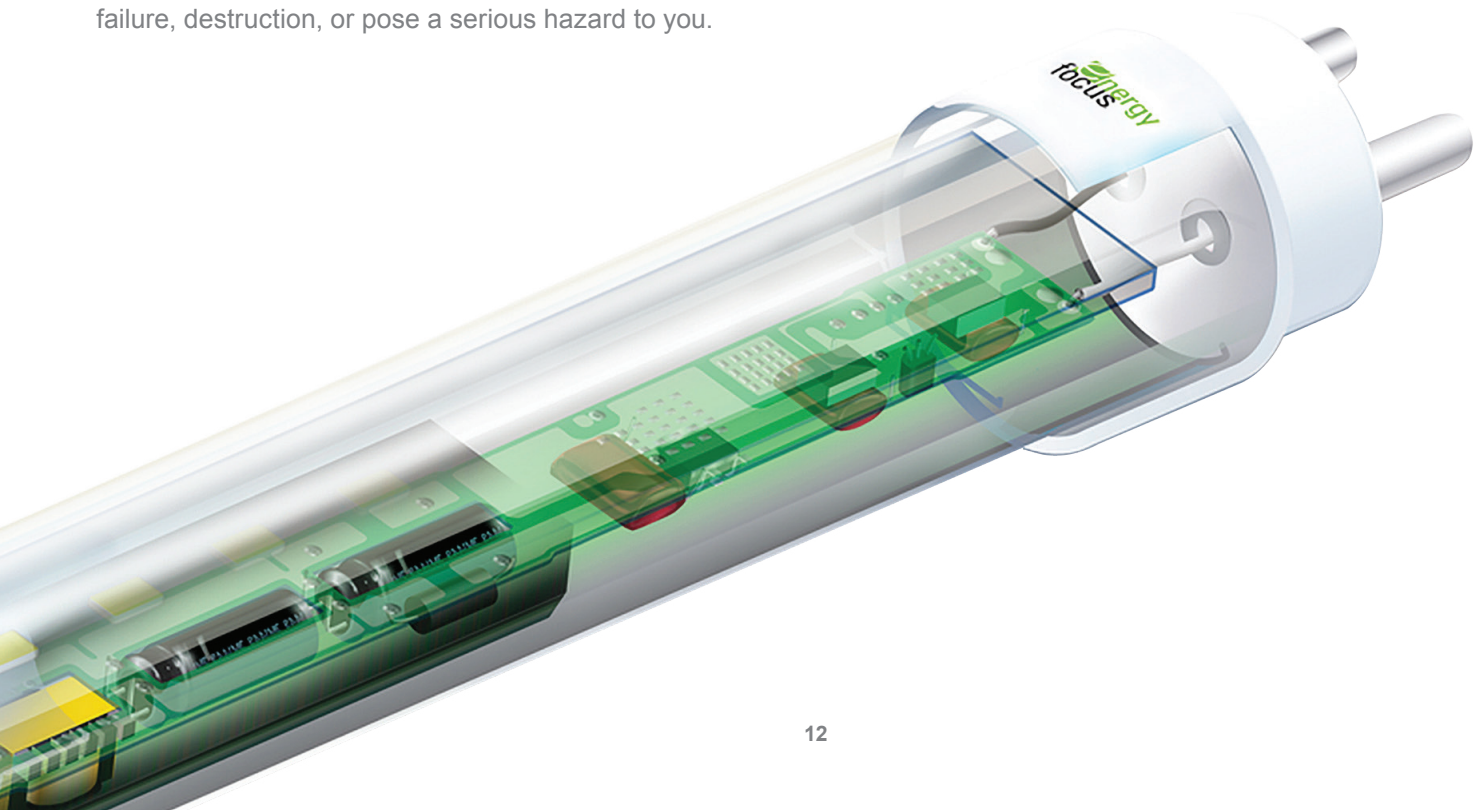
Hot Swapping in general refers to replacing a part of an electrical system with the power still connected. Some computer devices have components that are hot-swappable, such as a USB drive, that can be connected or removed while the computer is powered on. Energy Focus LED lighting products are **not** hot-swappable. Hot-swapping your lighting product can lead to product failure, destruction, or pose a serious hazard to you.

Following all Safety Instructions

Energy Focus is committed to your safety. We provide detailed safety instructions with all of our products and video tutorials highlighting best practices. Being well-informed is the best way to prevent any safety hazards from happening. If you lose your product instructions, they are available at www.energyfocus.com.

Replacing Tombstones when Re-wiring Fixture

When re-wiring your fixture to a Direct-Wire setting, to comply with UL standards you **MUST** replace your lampholder sockets/tombstones with new, non-shunted tombstones. With Energy Focus single-ended Direct-Wire TLEDs, only one of those sockets needs to be wired per tube, while the other socket functions solely as structural support.



Being a Responsible Buyer

Check Your Source

The LED lighting industry is sometimes referred to as the “Wild West”. Similar to the technology boom in the 1980s, there are thousands of LED manufacturers all vying for your business. Energy Focus encourages you to do some digging into a company’s history and track record. To the right are some great questions to ask about a company to ensure a safe and reliable product.

Look Up Registration Numbers

While governing bodies like UL, DLC, EnergyStar, and others have testing procedures and standards that manufacturers must answer to, these standards are regularly evolving with the technology. Manufacturers may have had a listing with any of these certifications and let it expire or advertise an out-of-date label. It is a best practice to check the websites of the organization for their qualified product lists. There you can verify whether or not the product in question is accurately represented.

Inquire About Lamp Testing

If you ever have any doubts, concerns, or questions about a product, we recommend inquiring with the manufacturer about testing. Any reputable manufacturer will be able to provide you with a variety of testing procedures and results on their product. At Energy Focus, we have a nationally standard laboratory with an integrating sphere for photometry as well as a pool of electrical testing apparatuses to provide you with a comprehensive report on any of our products as well as any competitor products.

How long have they been in the LED business?

Energy Focus is a 30 year old company with over 10 years of LED innovation experience.

Do they focus on LED lighting, or do they compete against themselves with other technologies?

Energy Focus manufactures LED lighting products only.

Are they publicly traded?

Energy Focus is a publicly traded company (NASDAQ: EFOI) since 1998.

Where are their headquarters?

Energy Focus World Headquarters are located in Solon Ohio.

Where do they manufacture their product?

Energy Focus offers Buy American products manufactured in Solon, Ohio.

What impact does their product have on the community and environment?

Energy Focus creates jobs in the US and supports Autism Speaks.

How long have they had successful installations of LED products?

Energy Focus has had military products on US Navy ships for ten years, with a 0% failure rate. Energy Focus has had commercial products in installations for over 6 years.

How many recalls have they had on products?

Energy Focus has never had a recall on a product.

What is their product failure rate?

Energy Focus failure rate is less than 1%.

What materials are they using in their product?

Energy Focus uses an aluminum backbone.





About Energy Focus

Energy Focus is an industry-leading innovator of energy-efficient LED lighting technology. As a producer of flicker-free LED products, our lighting solutions provide significant and measurable benefits over conventional and fluorescent lighting, including extensive energy savings, safety and health benefits, and improved aesthetics.

As a long-standing partner with the U.S. government, Energy Focus has a proud history delivering energy-efficient LED products to the U.S. Navy. Every unit we ship is subject to rigorous testing in the most adverse conditions possible, ensuring unparalleled quality and reliability. Our family of customers and partners include national, state and local U.S. government agencies as well as Fortune 500 companies across education, healthcare, retail and manufacturing industries. Energy Focus is headquartered in Solon, Ohio.

To contact an Energy Focus representative to visit your facility and find a customized lighting solution, please call 800. 327. 7877 or email customerservice@energyfocus.com



Energy Focus, Inc.
32000 Aurora Road
Solon, OH 44139

800.327.7877 • www.energyfocus.com

Follow us on

