The ABCs of LED Tubes (UL Type)

- Differences between UL Type A, B, and C
- Operations and maintenance considerations
- Installation cost/benefit comparisons

As a rapidly growing lighting technology, LED linear tube options are raising questions throughout the industry—it's important to know the options and which one will work best for you.

When considering LED Tube retrofits, it is important to understand the financial aspects as well as the installation, operations, and maintenance implications with three different options, which are commonly referred to as UL Type A, UL Type B, and UL Type C.

So, which LED Tube option is the most cost effective and the best solution for your application? Review the table below to compare each solution:

LED Tube Solutions & potential Decision Drivers

	Type A	Type B	Type C
Possible LED Tube Solution Benefits	• Installation process simplicity • Quickest installation • Lowest installation cost	• Overall system simplicity • Eliminate ballast compatibility questions • Avoid ballast failure and replacement • Excellent efficacy and maintenance savings	• Expanded performance capabilities • Controllable dimming system • Low voltage Class 2 output (minimizes risk of arcing)
Possible LED Tube Solution Drawbacks	• Incompatibility with existing ballasts impacts performance • System longevity depends on ballast • Dimming capability limited by ballast	• Highest installation cost • Additional safety precautions (fuse recommended) • Most do not dim	• Higher initial cost (requires LED Driver) • Moderate installation cost
Common LED Tube Applicaiton & Considerations	Type A, B and C LED Tubes are commonly used in partial and total lighting system retrofit projects and minor renovations where LFL lighting technology was previously used. Ideal for the following applications: • Retail • School • Banking • Commercial Office • Industrial* ***Note:** Type B Tubes are more susceptible to power surges and transients than Type A and Type C tubes, since they do not require a ballast or remote driver. Power quality issues are not uncommon in industrial & factory applications. For this reason, Type B LED tubes are not a recommended solution for Industrial settings.		

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Financial Consideration				
UL Type	**Type A** without Ballast Replacement	**Type A** + *Ballast Replacement	**Type B** (Double Ended Bypass)	**Type C**
Cost Per LED Tube	$12.00	$12.00	$12.00	$12.00
Number of Tubes	4	4	4	4
Cost Per Driver/Ballast	N/A	$11.00	N/A	$18.00
In-Line Fuse Kit	N/A	N/A	$8.00	N/A
Estimated Retrofit Time/ 4 Tubes (minutes)	4	12	15	12
**Labor Cost ($/hr)	$15.00	$93.20	$93.20	$93.20
Total Fixtures Retrofits Cost (4 Tubes)	$49.00	$77.64	$79.30	$84.64

Calculations are for example only and are meant to be directionally accurate in comparing options, but are not absolute.
* Ballast replacement is recommended if the installed ballast is more than 5 years old.
**Note: Labor rates will vary, but less skill is required to simply replace lamps. Costs based on certified electrician estimated hourly charges and minimum wage for Type A without ballast replacement (sources: Promatcher.com and bls.gov.)

Type A-Easiest Installation

LED Tube with Integrated Driver – Works with Existing or New LFL Ballast

Description: UL Type A tubes are designed with an internal driver that allows them to work with linear fluorescent ballasts. Compatibility between tubes and ballasts should be evaluated to ensure good system performance.

Advantages: UL Type A offers the simplest installation process— retrofitting involves a simple swap of the existing LFL with a UL Type A LED tube. Unlike the other options, no electrical or structural modification of the existing LFL fixture is required.

Disadvantages: However, with these benefits come some limitations. The longevity of a UL Type A system is dependent not only on the LED tube, but on the linear fluorescent ballast, which could result in additional maintenance costs within the lifetime of the solution. Ballast compatibility will vary by manufacturer and must be checked prior to install.

Additionally, a UL Type A tube solution sacrifices efficiency due to the power consumption of the ballast and is limited in dimming and controllability options.

Type B-Simplest Total System

Double-Ended Ballast Bypass LED Tube - Wired to Mains

Description: UL Type B tubes also have an internal driver. Rather than operating off a ballast, however, UL Type B lamps are powered directly from the mains voltage supplied to the existing LFL fixture, requiring several important and unique considerations. GE strongly recommends use of an in-line fuse with its Type B system for additional misapplication protection and offers an in-line fuse kit for ease of installation.

Advantages: UL Type B offers the simplest total system with respect to number of components — retrofitting involves wiring directly to mains voltage, bypassing the ballast. This removes any compatibility issues and eliminates maintenance costs associated with ballast replacements.

Disadvantages: Installation of a UL Type B system requires electrical modification of the existing fixture to connect the tubes to the power supply. This is more complicated than simply replacing lamps, and great care must to taken to follow installation instructions, as wiring may vary across different manufacturers' Type B solutions.

UL Type B is more efficient than UL Type A, with no ballast-driven power losses. However, most UL Type B LED tubes lack dimming and control capabilities.

It is important to note that the fixture's incoming power wires are connected directly to the sockets. As a result, installers may potentially be exposed to mains voltage during installation. For this reason, GE's double ended ballast bypass LED tube includes an internal safety switch designed to prevent current from flowing through the lamp until both ends of the LED tube are engaged with sockets. Strict adherence to installation instructions is critical when rewiring existing fixtures and utilizing UL Type B tubes.

Type C-Best Performance

LED Tube with Remote Driver

Description: UL Type C tubes operate off of a remote LED driver, rather than an integrated driver. Like UL Type B, UL Type C requires electrical modification to the existing fixture, but the low-voltage outputs of the driver are connected to the sockets instead of the mains voltage.

Advantages: Installation for UL Type C tubes involves removing existing tubes and ballasts. The fixture input wires must be connected to the LED driver, and the driver's low-voltage output wires must then be connected to the sockets before installing the new LED tubes. One driver can power multiple LED tubes throughout the fixture. GE's LED drivers have wiring that mimics that of instant start ballasts for ease of installation.

The UL Type C solution offers excellent system efficacy, ensures system compatibility, and great overall performance. It can be integrated with robust dimming and control functionality, helping to offset moderate labor and installation costs with heightened efficiency well into the future. GE's LED drivers feature Class 2 low voltage output, which eliminates the risk of pin arcing.

UL Considerations

If retrofitting an existing fixture that is UL approved with a UL-approved LED tube solution, the fixture will remain UL approved. If retrofitting an existing fixture that is not UL approved with a UL-approved LED tube, the fixture with the LED tubes would need to be submitted to UL for approval, if UL certification is necessary.

GE's Refit Solutions will keep intact the existing fixture's UL certification because retrofit solutions are certified by UL. GE customers must read the instructions provided with retrofit solutions prior to installation to understand inherent risks involved in altering existing systems.

As a more controllable technology than LFL, LED lighting can be successfully integrated into facilities' energy-efficiency planning. And with new LED tube options, the installation work can be done efficiently. GE's Refit Solutions can provide effective LED lighting anywhere fluorescent tubes currently exist.

Summary

To determine the best solution, one must consider the initial installation cost, long term maintenance implications, intended application, and overall which benefits are most desired:

- Type A without ballast replacement offers an easy plug & play solution with the lowest initial cost.
- Type B is the simplest total system, eliminating compatibility issues, but also has the highest installation cost.
- Type C has a higher upfront cost but is the best future-proofing solution as it offers the ability to work with controls that are currently in place or are installed at a later time.

To learn more about GE's Type A, Type B, and Type C options click here or contact your GE sales representative.

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