Learning the ABCs of LED Tubes with MaxLite

Replacing fluorescent tubes with LED is the simple way to save energy!

There are four options when it comes to considering LED tube retrofits: UL Type A, UL Type B, UL Type C and Dual-Mode (UL Type A+B). It is important to understand the features and differences in installation, operation and maintenance of each type of lamp in order to identify the solution that will work best for your lighting project. Here's a simple guide to the differences between UL Types A, B, C and Dual-Mode (A+B):

LED Lamp Solutions by UL Type

	Type A Ballast Compatible	Type B Bypass Ballast	Type C External Driver	Type A+B Dual-Mode
Benefits	• Easiest to install • No modification to the fixture	• More efficient vs. Type A • Longer lifetime vs. Type A • No compatibility issues	• Highest efficiency • Highest reliability • Longest lifespan	• Installation as Type A or Type B
Potential Drawbacks	• Less efficient • Must be compatible with existing ballast • Lifetime limited by ballast • Dimming capability limited by ballast	• Requires fixture modification and relabeling • Limited dimming and control capabilities • More susceptible to power surges and transients	• Higher product cost than Type A or Type B • Installation requires fixture modification and re-labeling	• Must ensure anti-shock mechanism is used internally • All UL required warning labels should be packaged with the product • Limited dimming and control capabilities
Cost Summary	Lowest initial cost	Highest installation cost	Highest upfront cost, Lowest long-term cost	Varies based on operating mode
Cost per Tube	$5-$10	$5-$8	$6-$10	$7-$8
Cost per Driver	N/A	N/A	$10-$15	N/A
Labor Cost ($26.01/hr)	$26.01 5 minutes (add time if replacing ballast)	$26.01 25 minutes	$26.01 20 minutes	$26.01 5-20 minutes
Total Cost (4 tube fixture)	$31-$36 $39-$44 w/ ballast ($8)	$31-34	$42-$52	$33-$34
Considerations	• Every ballast in an installation must be audited first • Ballasts may be old/out of warranty; replacement ensures performance and reliability • Mismatch can lead to flickers, buzzing or worse	• Not recommended for industrial settings where power quality could be an issue • Fixture can no longer accept fluorescent tubes	• Replaces lamp and ballast with dedicated system driver • Most widely recommended choice	• Ballast audit must be completed for Type A • All considerations for Type A and Type B apply, and depend on method chosen • Utility rebates may be withheld if the utility is rebating for only one of the two UL types • Quality of product and qualified labor are critical safety factors

Costs are approximated, and vary depending on wattage.

Labor rates will vary. Median pay per hour, $26.01. Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, Electricians, on the Internet at https://www.bls.gov/ooh/construction-and-extraction/electricians.htm (visited April 2, 2019).

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Type A
Ballast Compatible

Description:
UL Type A tubes are a “plug-and-play” solution. They are built with an internal driver that enables the LED tube to operate on the existing fluorescent linear ballast.

Advantages:
UL Type A tubes offer the easiest installation process since there is no modification to the fixture itself.

Disadvantages:
The entire installation must undergo a ballast compatibility audit before any fixtures are retrofitted with UL Type A tubes. Depending on the age and maintenance of the fixtures, there may be several different types of ballasts that must be factored into a single project. The longevity of the LED lighting system will depend on the reliability of the existing fluorescent ballast. Failure of the existing ballast could result in additional maintenance costs over the lifetime of the system; therefore, ballast replacement is strongly recommended. Power consumption by the existing ballast also lowers the efficiency of the system.

Type B
Ballast Bypass

Description:
While UL Type B tubes also have an internal driver, they are powered directly from the mains voltage supplied to the existing fixture instead of operating off the ballast.

Advantages:
UL Type B tubes operate more efficiently than UL Type A because they bypass the ballast. This extends the lifetime of the system, and eliminates compatibility issues and on-going maintenance costs associated with ballast replacements.

Disadvantages:
Installation of UL Type B tubes is more complex, as it requires electrical modification of the existing fixture to connect the tubes to the power supply. Installation may also require replacement of the socket. Once the fixture is modified, it can no longer accept fluorescent tubes. Care must be taken to properly re-label the modified fixture to ensure end-user safety.

UL Type B tubes operate more efficiently, but they have limited dimming and control capabilities, which may present an issue for some applications. Note that some Type B tubes use single-ended connections and others use double-ended connections.

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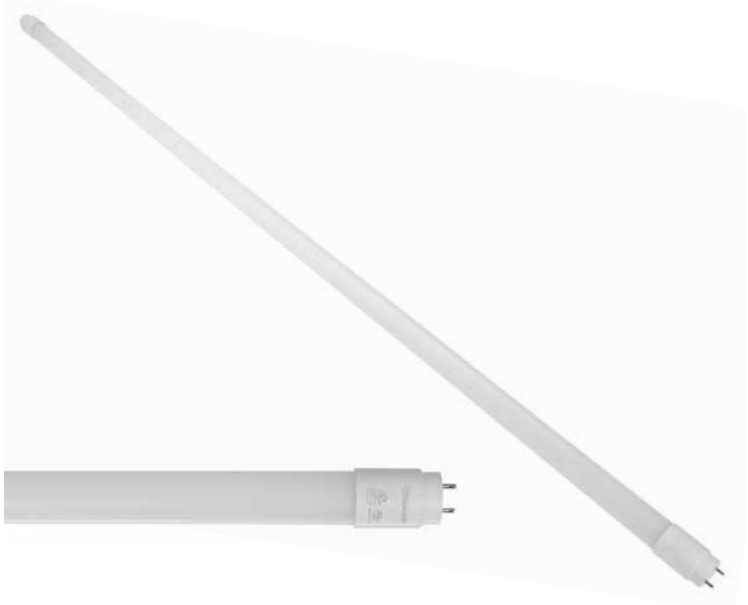
Type C
External Driver

Description:
UL Type C tubes operate off of an external, low-voltage LED driver that connects to the sockets instead of the mains voltage. The existing fluorescent ballast is removed from the fixture.

Advantages:
UL Type C tubes are the most efficient and reliable retrofit solution. The external driver is not limited to size constraints inside the tube, and facilitates dimming and controls to be incorporated into the lighting system. One driver can power multiple LED tubes throughout the same fixture.

UL Type C tubes offer a longer lifespan and easier long-term maintenance. Since the driver is not coupled to the LEDs, the risk of arcing and overheating present in other types of tubes is greatly reduced, and the driver and tubes can be replaced independently of one another in the field. UL Type C drivers operate with limited current output, thereby eliminating the potential safety risks associated with UL Type A and UL Type B solutions.

Disadvantages:
UL Type C tubes have a slightly higher upfront cost than Type A or Type B options. As with UL Type B, installation requires fixture modification and re-labeling.



Type A+B
Dual-Mode

Description:
Commonly known as dual-mode lamps, UL Type A+B Lamps can be used with a compatible fluorescent ballast (UL-A) or ballast bypass (UL-B).

Advantages:
Dual-mode lamps may be installed in either UL Type A or UL Type B fixture configurations, taking into consideration all the advantages and disadvantages previously discussed. Choosing a quality tube that is designed for optimal safety during installation and operation is very important. MaxLite's Hybrid Series (UL Type A+B) lamps are built with integrated circuit (IC) technology that detects the lamp connection and corresponding operating mode. Each pin at the lamp base is engineered with a thermal fuse that detects overheating and responds by automatically shutting the lamp off.

Disadvantages:
Currently, there are different utility rebates associated with UL Type A, UL Type B and UL Type C tubes, and rebates can vary widely through individual utility programs. If a utility determines that a tube is both UL Type A and UL Type B, but only offers a rebate for one of the two types, the rebate may be withheld.

Only a qualified, trained electrician should install or retrofit dual-mode LED lamps in lighting fixtures.

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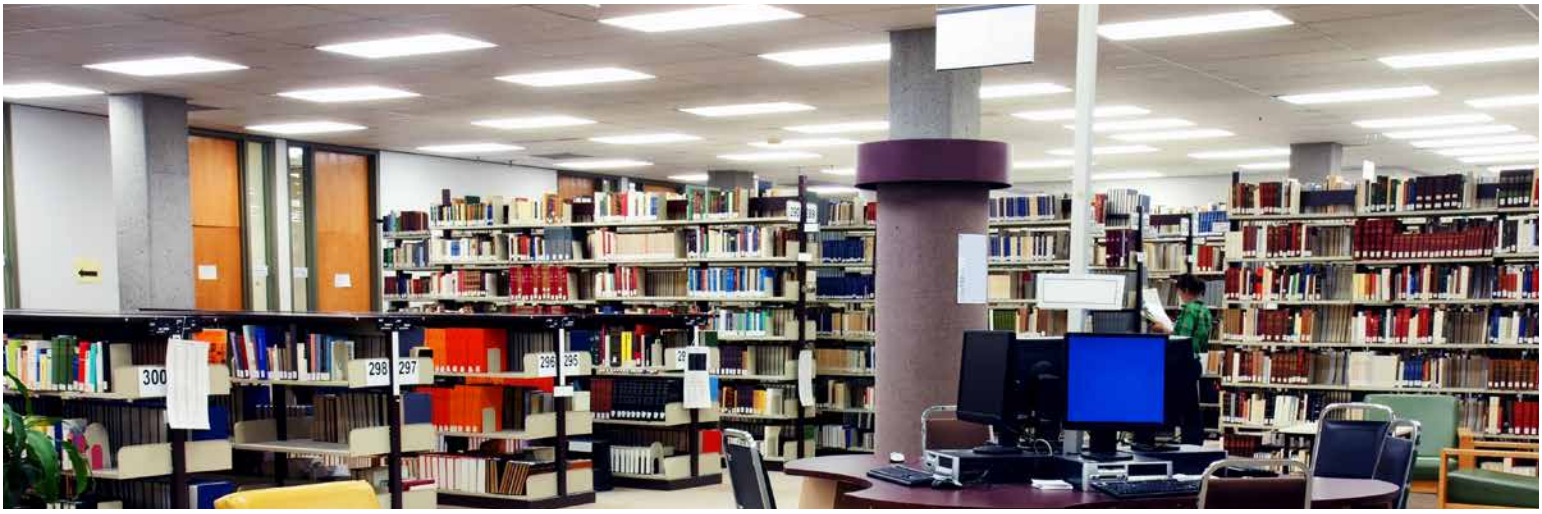
UL Listing

Retrofitting an existing UL-listed fixture with a UL-classified retrofit kit results in a UL-certified installation. Please consult a MaxLite representative with any specific questions regarding UL certification. UL also offers a Field Evaluation service for customers who wish to have a product evaluated.

Reference:
Underwriters Laboratories (UL) (2010). "Luminaire Ballast Retrofits and Conversions: How does that affect the luminaire listing?" The Code Authority: Electrical Connections newsletter, September 2010



Summary

To identify the best LED retrofit solution, one must consider initial installation costs, system maintenance, intended application, and product benefits most desired:

- Type A is a plug-and-play solution with the lowest initial cost, but lowest efficiency and reliability.
- Type B eliminates compatibility issues, but has a slightly higher installation cost, and may lack dimming capabilities.
- Type C has the highest product cost, but offers the highest efficiency and long-term reliability, as well as dimming and controls capabilities.
- Type A+B offers versatility, but requires careful product selection and electrical labor practices to ensure safety.

MaxLite offers UL Type A, UL Type B, UL Type C, and dual-mode (UL Type A+B) tubes. To learn more about MaxLite's LED retrofit solutions contact a representative today!