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Direct LED Tube Replacements Designed To Use Fluorescent Tube Ballasts
What are they not telling us?

Replacing fluorescent tubes with LED tubes is both a wise economic and environmental decision. LED lighting promises to provide less maintenance and both greater performance and stability than any other lighting product on the market today. However, not replacing the fluorescent tube ballast may seem a more economic short term decision but in reality becomes a decision fraught with long term expense and headache.

Here are some of the problems that will be encountered if the fluorescent ballast is not replaced with an LED driver:

Cost:

There are many varieties of fluorescent lamp and ballast combinations. Knowing what ballast is critical in determining if an LED tube will work with your ballast. Is your ballast magnetic or electronic type? Is it instant start, rapid start, programmed start or hybrid? Is it wired for two tubes in parallel or in series? Not being armed with this information prior to purchasing an LED tube designed for use with a ballast can lead to very expensive mistakes.

Reactive Ballasts (magnetic) - Losses in the magnetic ballast due to its resistance and losses in its magnetic core may be significant, on the order of 5 to 25% of the lamp input electric power.

Electronic Ballasts - Electronic ballast uses solid state electronic circuitry to provide the proper starting and operating electrical conditions to power fluorescent lamps.

Instant Start - Instant start ballasts do not preheat the electrodes, instead using a relatively high voltage (~600 V) to initiate the discharge arc. Instant-start ballasts are best suited to applications with long duty cycles, where the lamps are not frequently turned on and off.

Rapid Start - Rapid start ballasts apply voltage and heats the cathodes simultaneously but uses slightly more energy as the cathodes in each end of the lamp continue to consume heating power as the lamp operates.

Programmed Start – Programmed start ballasts apply power to the filaments first, it allows the cathodes to preheat and then applies voltage to the lamps to strike an arc.

Hybrid - Hybrid ballast has a magnetic core-and-coil transformer and an electronic switch for the electrode-heating circuit. Like a magnetic ballast, a hybrid unit operates at line power frequency—60 Hz in North America. These types of ballasts, which are also referred to as “cathode-disconnect ballasts”, disconnect the electrode-heating circuit after they start the lamps.

Purchasing LED tubes requiring a ballast commits you to keeping the ballast tube technology. Chances are the LED tube will last much longer than the ballast requiring you to replace the ballasts in order to continue using the LED tube. Replacing the fluorescent ballast can cost as much or more than the original cost of the entire fixture.

Ballasts often require as much or more maintenance than the fluorescent tubes. A ballast that has gone bad but still operates may greatly shorten the life of the LED tube. Ballasts draw current as well as the “in-tube” driver in the LED tube; this uses more electricity than using an external LED driver.

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Noise:

Fluorescent lighting ballasts produce a vibration (a slight buzzing sound) that originates in the core and coil assembly of electromagnetic ballasts. The buzzing sound can increase based on a variety of factors, including: The fashion in which the ballast is mounted in the fixture, the design of the fluorescent lamp fixture, reverberating characteristics of the ceiling, walls, floors and furniture, ballast size (the larger the ballast, the more humming it generates), and ballast age (the older the ballast, the louder the humming)

All ballasts carry a published sound rating of A, B, C, or D. These sound ratings are based on measurements of average ambient noise levels during conditions of normal occupancy. The chart illustrates the average ambient noise level per application, and the corresponding recommended sound rating.

Application	Sound level rating*	Average ambient noise level of interior
Library, reception, reading room, church, school study hall, TV/Radio station	A	20 - 24 decibels
Classroom, residence, quiet office	B	25 - 30 decibels
Commercial building, general office area	C	31 - 36 decibels
Manufacturing facility, warehouse, retail store	D	37 - 42 decibels

*These sound ratings are based off average ambient noise measurements during normal occupancy conditions. Amplified audible ballast hum may occur during exceptionnaly quiet periods and at times when area is unoccupied.

Safety:

Ballast LED tubes must be matched to the 'series' or 'parallel' type of ballast. If series, power is at both ends of the tube and may result in severe electric shock when replacing tube. External LED driver systems do not use the tube pins to conduct power and therefore are safer to replace.

Features:

Ballast LED tubes normally cannot use additional features such as dimming and smart lighting technology such as 'end-of-life' warnings.

Life:

STANDARD fluorescent magnetic and electronic ballasts are intended to operate an average of 24,000 hours (at maximum rated case temperature). The useful life of a fluorescent ballast depends on the daily hours of operation and the operating temperature, the latter being the most critical. It is important to note that increasing the operating temperature by 10°C will cut the life expectancy in half, and lowering it by 10°C, will double ballast life. An LED tube requiring a ballast is usually rated for 40,000 hours which means the LED tube lasts longer than the ballast requiring ballast replacement in order to get the full ROI of the LED tube. Once the LED tube reaches end-of-life another LED tube requiring a ballast must be purchased in order to realize full ROI on the replacement ballast condemning you to a never ending cycle of out dated ballast technology.

LED tubes that use an LED driver operate an average of 75,000 hours and the LED driver is designed to last equally as long. This means it will last 2 or 3 times longer at a greater ROI than a ballast system.

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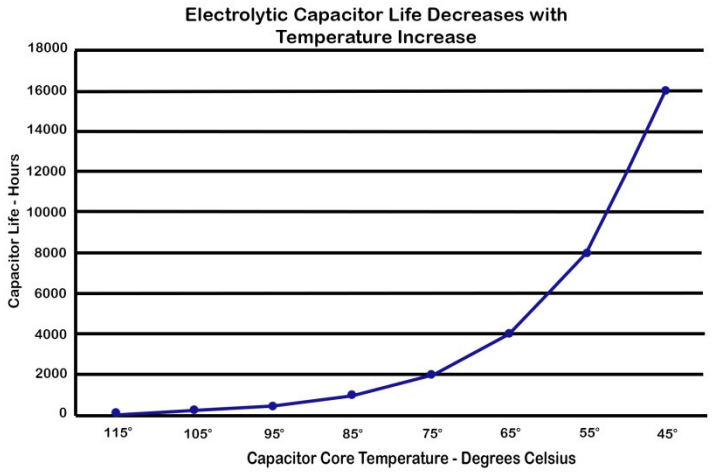
Flicker:

LED lighting systems are usually run on DC voltages to eliminate light flicker. One of the most common causes of LED flicker is ripple voltage/current. Ripple voltage/current is the small power fluxuations that remain once the AC power has been converted to DC power. LEDs are very responsive to changes in current and voltage. The higher the voltage/current the brighter the light and the more heat it produces. Too much voltage/current can destroy the LED. The DC power supply (LED Driver) is critical to maintaining both the consistent color temperature and lumens but also the longevity of the LEDs as it converts AC voltage to a very stable and constant DC voltage. One item in any LED Driver, (small 'in-tube LED driver' or external LED driver,) that is critical to this function is the smoothing capacitor.

Function of capacitors

Capacitors act as an electrical accumulator, taking in excess power to help maintain a constant voltage or power level. Analogous to a shock absorber in a car, the capacitor acts to slow any changes in the input power, while allowing a metered amount of energy to exit. In the automobile, bumps in the road cause the changes in input power, and the result of slowing these changes is a smooth ride. In the electrical circuit, the capacitor takes variations in the input and creates a regulated output and in the process the difference between the input and output energy converts to heat within the capacitor. In typical power electronics applications, the electrolytic capacitor takes delivered AC power and converts it to a constant voltage output. In the case of converting AC to DC inside a direct replacement LED tube it eliminates or diminishes AC ripple in the DC voltage. AC ripple is what causes flicker in LED lights.

Electrolytic capacitors use a semi-liquid electrolyte inside the case to make electrical contact with the foil windings. This electrical interface is inherent in the capacitor's ability to carry current and function as an energy storage unit for the electrical power input. When the interface between the electrolyte and the metallic foil windings begins to degrade, the electrical connection begins to fail. Heat buildup is the primary cause of this degradation, which, depending on severity, can cause either short-term catastrophic failure, or long term functional degradation. Similar to the life expectancy of a silicon semiconductor die, the life expectancy of an electrolytic capacitor relates directly to its internal temperature.



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The structure and materials used in the capacitor make heat dissipation more difficult. To operate properly, the case must be electrically isolated from the core where heat is generated. Even though the capacitor specifications usually require a 1" spacing, the demand for smaller packages overrides the capacitor's need for cooling. In the case of an LED fluorescent tube additional space is not possible and the capacitor is often placed within direct proximity of the high temperature heat sink being used to cool the LEDs. The result of this tight spacing is shorter capacitor lifetime.

In Conclusion:

Number of deficiencies for the ballast compatible LED tube:

- It doesn't work with most ballast types. If the ballast turns out to be incompatible with the ballast compatible LED T8, the user ends up having to buy and replace both the ballast and LED tube. In the case of an older facility that has multiple types of ballast, it will be hit-and-miss when it comes to figuring out which ballast is compatible.
- It doesn't work without ballasts. As such, the user is forced to buy and replace the ballast for as long as they continue to use the ballast compatible LED tubes.
- The life of the ballast is shorter than that of the LED tube. This means the user needs to make a ballast replacement at least once for each ballast compatible LED T8, with the cost of replacing all dead ballast one-by-one being much higher than retrofitting all fixtures in a facility at the same time.
- The ballast and the LED tube never die at the same time. Thus, twice the amount of overall maintenance work is required to keep both the LED tube and the ballast working.
- The ballast continues to draw unnecessary power even when the tubes are turned off. Not a good energy-efficient choice.
- The cost of implementing and maintaining the operation of ballast compatible LED tubes is more than twice the cost of using LED tubes with an LED driver.

Engineer's final word:

Titan LED designs the Titanium Series tube with the best components possible, Philips diodes are utilized combined with a highly efficient driver that has been engineered and designed for this specific LED array. Companies that choose to use old existing fluorescent ballast to operate their LED tubes force their clients to unknowingly endure many long term inefficiencies by attracting them with lower initial capital costs. First the power consumption of these supposedly efficient tubes typically draws higher wattage, even though they are LEDs. The very wide variety of different ballast existing in the field are plagued with numerous inherent problems from low power factors to unstable non constant (flickering) power designed to operate antiquated fluorescent technology not state of the art LED technology. The Titan LED driver in use with the latest Titanium series tubes has a 1.0 power factor and it delivers constant clean current to the LED array. This product has been thoroughly engineered and designed to work with our specific LED configuration making the whole design perfectly balanced and highly efficient.

The LED tube/ballast system will require the LED tube (40,000 hours) to be replaced at least twice and the ballast (24,000 hours) to be replaced at least three times, including all associated labor costs, to equal the same lifespan one just one of our Titan LED Tube/Driver combination lasting 75,000 hours.

Ballasts, by design, emit a pulse of high voltage electricity when first turned on to ignite the gasses in a fluorescent tube. After this initial pulse the IC chip circuitry then supplies a lower current to maintain the gas ignition. This type of electrical behavior was never designed to efficiently support an LED array. I must emphasize that this constant containment of pulsed high voltage starter energy will eventually and prematurely damage critical operating components within the LED tube.

Technology is advancing at a rapid pace making the LED light a state of the art product in both energy efficiency and light efficacy. To place these high end electrical components into a fixture that was designed for a completely different type of lighting technology is, in my opinion, counterproductive, counterintuitive and fiscally risky.

Titan LED

Titan LED is a California based OEM and manufacturer specializing in Energy Efficiency and Clean Tech lighting solutions. We offer a broad range of proprietary and cutting edge products designed to install and retrofit into a variety of existing infrastructures which include; Warehouse, Retail, Hospitals, Municipalities, & Small Businesses.
With a growing network of agents, Titan LED brings professional services and commitment to exceptional levels. Our sales team is dedicated at demonstrating substantial Cost Savings of 50-75% to our customers and delivering quality results. While this caliber of energy savings is a primary focus, LED's also yield multiple built-in benefits that stand independently strong.

TITAN LED TUBES:

http://www.titanled.net/home.php#!titan-tube-light/cvy1