Why iBright™

ATG ELECTRONICS

Background

LED technology continues to develop rapidly as a general light source, and more LED light fixtures, for example T8 LED replacement lamps, have been introduced on the market. Recently, commercially available white LEDs luminous efficacy have achieved over 90 lm/w, compared with 80-100 lm/w of existing T8 fluorescent lamp. Existing T8 fluorescent lamps work with troffers, whose efficiency ranges from only 60% to 74%. In addition to having a high efficacy, LEDs also have a longer life time, they save energy and are mercury free.

Purpose

It is not always practical to replace existing T8 fluorescent lamps with T8 LED replacement lamps. Not all T8 LED replacement lamps are good replacements for conventional T8's.

This fact sheet makes describes a detailed comparison on performance of T8's. The focus lies on optical, electrical, thermal and reliability. The compared products are iBright™ T8 LED replacement lamps, Philips T8 fluorescent lamps and commercially available T8 LED replacement lamps from other suppliers.

Introduction of iBright™

iBright™ T8 LED replacement lamps use LEDs technology to replace conventional fluorescent lamps. They feature

1) Patented heat sink design, good thermal management;
2) Imported high quality SMD LEDs, around 90lm/w efficacy;
3) Less than 4% lumen depreciation within 5000hrs continuous burning;
4) 2-3 years warranty;
5) Truly CE certified, including EMC and LVD.

iBright™ vs Philips

Table 1 Specifications Comparison (iBright™ vs Philips)

	iBright™ HFL-8060N-120602-H0, 1.2m/4ft	**Philips ALTO T8 32W**
Physical Specifications		
Lamp Base	G13	G13
Electrical Specifications		
Power Consumption (W)	20±1 (incl. driver)	40±1 (incl. ballast)
Input Voltage (VAC)	100~240 VAC	100~240 VAC
Power Factor (%)	>0.95	0.97
Optical Specifications		
Luminous Flux (lm)	1500±100	2500±100
Illumination (lux)	360@1m	362@1m
	114@2m	119@2m
	58@3m	61@3m
Luminous Efficacy (lm/w)	85 (incl. driver)	68 (incl. ballast)
Luminaire Efficiency (%)	100 (troffer unneeded)	60-74 (troffer needed)
Color Temperature (K)	6000~6500	6500
Color Rendering Index	>80	78
Beam Angle (°)	120	360
Life Time (Hrs)	50,000~60,000	10,000~20,000
Lumen Maintenance (%)	>96@5,000hrs	≤80@5,000hrs
Thermal Specifications		
Operating Temperature (℃)	-20~40℃	-10~50℃

iBright™ Payback and Saving Calculation

Table 2 iBright™ Payback and Saving Calculation[1]

	iBright™ HFL-8060N-120602-H0, 1.2m/4ft	**Philips ALTO T8 32W**
Lamp Power	20±1 (incl. driver)	40±1 (incl. ballast)
Lamp Cost	US$50.00	US$24.75[2]
Energy Cost[3]	US$219.00[4]	US$438.00[5]
Maintenance Cost[6]	US$8.00	US$40.00[7]
Total Cost[8]	US$277.00	US$502.75
Total Savings	**US$225.75** [9]	

1) The calculation conditions are based upon 24 hours per day, 365 days per year and 5 years operating, and US$0.25/kWh for electricity rate.

2) The calculation conditions are based on $4.95 per lamp (data source www.shopping.com), 1-year life for each Philips T8 fluorescent lamp. $24.75=$4.95/lamp x 5 lamps.

3) Energy cost is based on 5 years operating; calculation formula is hours x lamp power x electricity rate/1000.

4) $219.00=5 years x 365 days/year x 24 hrs/day x 20W x $0.25/kWh/1000.

5) $438.00=5 years x 365 days/year x 24hs/day x 40W x $0.25/kWh/1000.

6) Average $8 per lamp labor cost for maintenance.

7) $40.00=$8/lamp x 5 lamps.

8) Total cost=lamp cost + energy cost + maintenance cost.

9) $225.75=$502.75-$277.

Additional Comparison

	iBright™	Philips
Radiation	RoHS compliant	UV, IR
Toxicant	RoHS compliant	Toxic phosphor powders, Mercury (Hg), Lead (Pb)
CO_2 emission	Low	High
Heat damage	No	High
Fragile	Durable, Aluminum Housing and PC Cover	Fragile Glass
Burn out failure	No	Yes
Flicker	Never	Frequently
Light wasted on reflector	No	High
Buzzing	No	Yes
EMI emissions	No friendly to electronic equipment	Yes harmful to electronic equipment
Recyclable	Yes	No
Low temperature working environment	Compatible	Incompatible
Ballast needed	No	Yes
Starter needed	No	Yes
Maintenance Fee	Low	High

iBright™ vs Common T8 LED Replacement Lamps

Overview

Currently, the most efficacious white LEDs can perform similarly to fluorescent lamp. However, LED efficacy doesn't tell the whole story. Good T8 LED replacement lamps shall combine high efficacy and brand LEDs, excellent thermal management, and sophisticated optical design. Conversely, poorly-designed T8 LED replacement lamps using even the best LEDs may be no more efficient or no longer life over existing T8 fluorescent lamps.

One of the most basic decision factors for T8 LED replacement lamp selection is longevity of the lamp. However, the lighting industry has very limited direct experience with long-term performance and reliability of T8 LED replacement lamps.

In summary, T8 LED replacement lamp life is not identical to estimated LED life. T8 LED replacement lamp life is also a function of the power supply, operating temperatures, thermal management, materials and electrical and material interfaces. How can T8 LED replacement lamp reliability be assessed? Some things to look for:

- Use of high quality LEDs from brand suppliers who publish reliability data.
- Superior heat sink design to dissipate heat, minimizing T8 LED replacement lamp temperature (for example, board, case, or solder joint temperature) as low as possible.
- Optical specification from independent testing laboratory or manufacturer in-house testing.
- Warranty offered by the manufacturer should be at least comparable to traditional fluorescent lamp for the application under consideration.
- Any test data available about longer term performance of T8 LED replacement lamp.

Common T8 LED replacement lamp

Common T8 LED replacement lamp features a linear array of 5mm DIP LEDs (suitable for indication applications, ranging from 60 to 400 LEDs per lamp), with airtight clear tubular plastic or glass covers as heat sink and diffuser, and integrated driver (non-isolated constant voltage type). As plastic and glass are not good heat conduction materials, this kind of design will cause heat buildup inside the tube, depreciate lumen quickly and shorten useful life of T8 LED replacement lamp.

In contrast, iBright™ T8 LED replacement lamp features a linear array of imported high quality SMD LEDs (ranging from 30 to 88 LEDs per lamp), with patented design of aluminum housing as heat sink, stripped PC cover as diffuser and UL listed integrated driver (isolated constant current type).

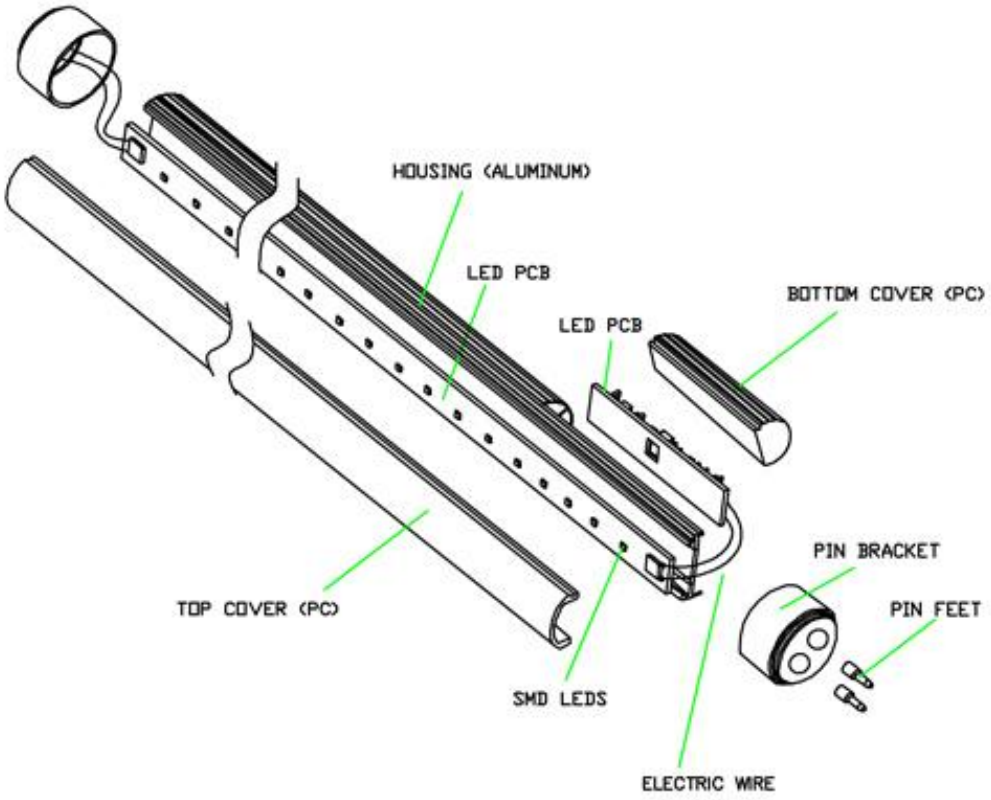
Critical Term Comparison, iBright™ vs. Common T8 LED Replacement Lamps

	iBright™ HFL-8060N-120602-H0, 1.2m/4ft	Common LED Fluorescent Lamp 1.2m/4ft
Physical Specifications		
Lighting Source	Imported high quality SMD LEDs	5mm DIP LEDs
Life Time (Hrs)	50,000~60,000	5,000~10,000
Electrical Specifications		
Power Consumption (W)	20±1 (incl. driver)	20±1 (incl. driver)
Power Factor	>0.95	0.75
Optical Specifications		
Lumen Maintenance (%)	>96@10,000 Hrs	<60@5000 Hrs
Thermal Specifications		
Case Temperature (℃)	50	34.6[1]
Solder Joint Temperature (℃)	52	>70[1]
Junction Temperature (℃)	<73	>110[1]

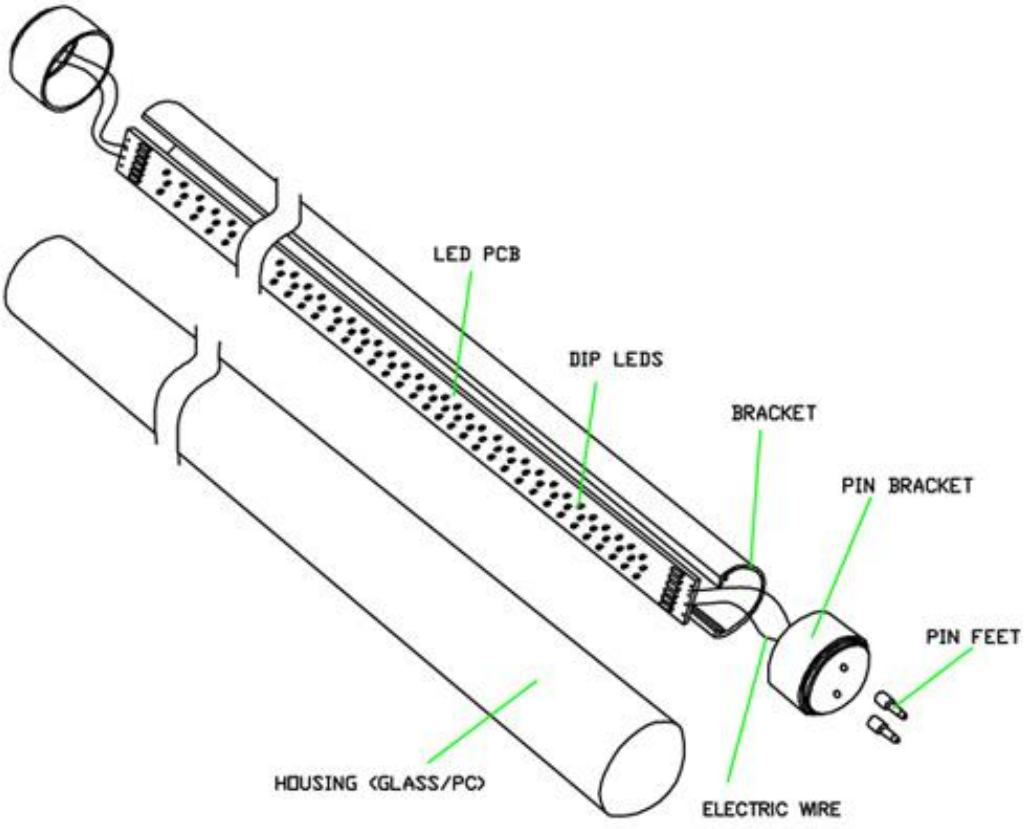
1) These temperature numbers proves common T8 LED replacement lamp has much heat buildup inside the tube, shortening the lamp life.

Exploded Drawing Comparison

iBright™

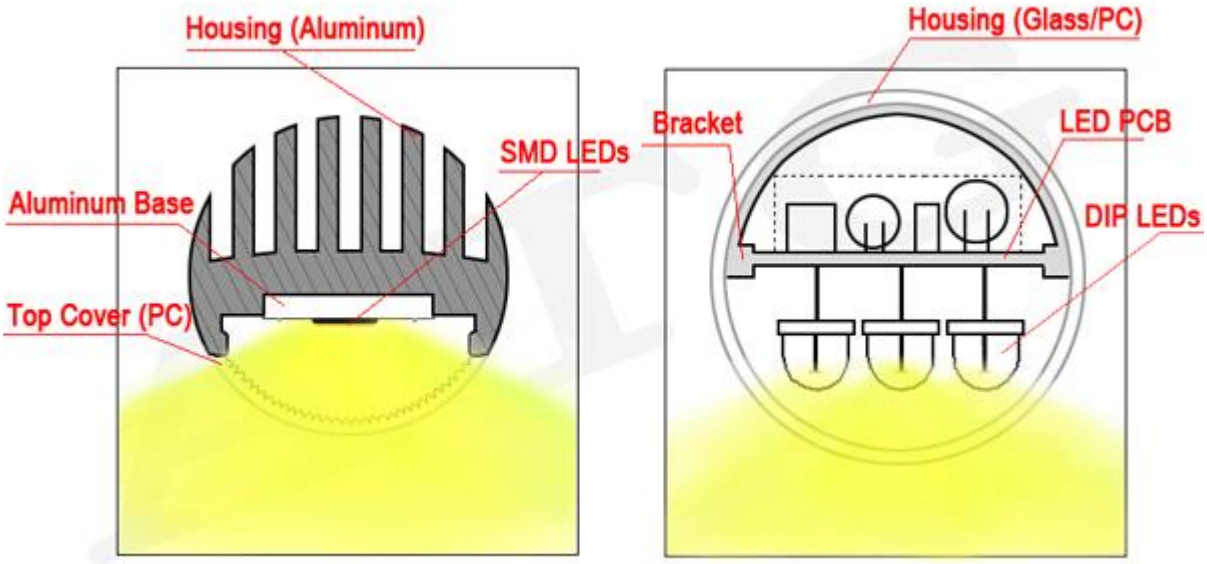


Common T8 LED replacement lamp



Section Drawing Comparison

iBright™ **Common T8 LED replacement lamp**



Conculsion

iBright™ vs Philips

iBright™ is using imported high quality SMD LEDs, of high luminous efficacy (typical 90lm/w). They have similar light quality as Philips. Table 1 shows that illuminance (lux) of iBright™ is comparable with Philips's.

iBright™ are 50% energy saving compared to Philips. The energy-efficient iBright™ keeps on burning for up to 50,000 hours significantly reducing the time spent on replacing defective lamps. Therefore, iBright™ not only lowers energy bills, but also maintenance and replacement costs.

iBright™ are RoHS compliant and contain no toxic phosphor powders, mercury (Hg) or lead (Pb) which is always seen in conventional fluorescent lamps.

iBright™ vs Common T8 LED replacement lamp

iBright™ are much more reliable than common T8 LED replacement lamps on the markets:

1) they are made of imported high quality SMD LEDs, with low lumen depreciation;

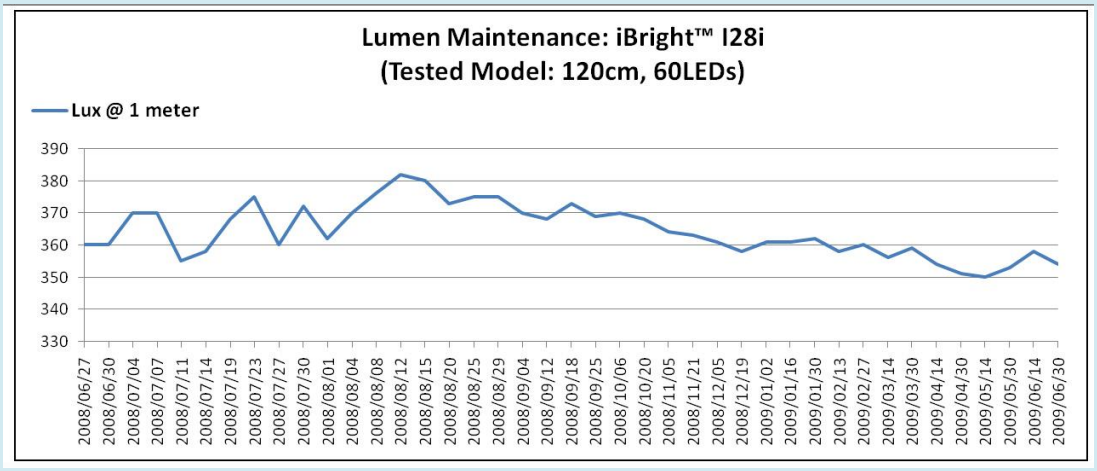
2) they are using specially designed aluminum housing with good heat dissipation, and have no heat buildup inside;

3) they are using specially designed loop circuit, one LED fail won't make the whole lamp fail.

Appendix

iBright™ lumen maintenance data[1]

Date	Lux@1m	Date	Lux@1m	Date	Lux@1m
2008/6/27[2]	360	2008/8/15	380	2009/1/2	361
2008/6/30	360	2008/8/20	373	2009/1/16	361
2008/7/4	370	2008/8/25	375	2009/1/30	362
2008/7/7	370	2008/8/29	375	2009/2/13	358
2008/7/11	355	2008/9/4	370	2009/2/27	360
2008/7/14	358	2008/9/12	368	2009/3/14	356
2008/7/19	368	2008/9/18	373	2009/3/30	359
2008/7/23	375	2008/9/25	369	2009/4/14	354
2008/7/27	360	2008/10/6	370	2009/4/30	351
2008/7/30	372	2008/10/20	368	2009/5/14	350
2008/8/1	362	2008/11/5	364	2009/5/30	353
2008/8/4	370	2008/11/21	363	2009/6/14	358
2008/8/8	376	2008/12/5	361	2009/6/30	354
2008/8/12	382	2008/12/19	358		



1) This test is implemented by ATG Electronics in-house testing engineers; test conditions are based on iBright™ G2 IPS (Part Number HFL-8060N-120602-H2), 25℃ ambient temperature, 24Hrs per day 7 days per week running and illumination maintenance (lux) at 1m.

2) This test starts from June 27th, 2008.

External Links

LED Basics

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led_basics.pdf

Luminaire Efficacy

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/luminaire_efficacy.pdf

Luminaire Reliability

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/luminaire_reliability.pdf

Energy Efficiency of White LEDs

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/energy_efficiency_white_leds.pdf

Lifetime of White LEDs

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/lifetime_white_leds_aug16_r1.pdf

DOE CALiPER 08-19 Replacement T8 Round 5

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ns/caliper_08-19_t8.pdf

DOE CALiPER 08-37 Replacement T8 Round 5

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ns/caliper_08-37_t8.pdf

Glossary Terms

Light-emitting diodes (LEDs) are based on inorganic (non-carbon based) materials. An LED is a semi-conducting device that produces light when an electrical current flows through it. LEDs were first developed in the 1960s but were used only in indicator applications until recently.

General illumination is a term used to distinguish between lighting that illuminates tasks, spaces, or objects from lighting used in indicator or purely decorative applications. In most cases, general illumination is provided by white light sources, including incandescent, fluorescent, high-intensity discharge sources, and white LEDs. Lighting used for indication or decoration is often monochromatic, as in traffic lights, exit signs, vehicle brake lights, signage, and holiday lights.

Luminous efficacy is the most commonly used measure of the energy efficiency of a light source. It is stated in lumens per watt (lm/W), indicating the amount of light a light source produces for each watt of electricity consumed. For white high-brightness LEDs, luminous efficacy published by LED manufacturers typically refers to the LED chip only, and doesn't include driver losses. See more information in the Energy Efficiency section.

Correlated color temperature (CCT) is the measure used to describe the relative color appearance of a white light source. CCT indicates whether a light source appears more yellow/gold/orange or more blue, in terms of the range of available shades of "white." CCT is given in kelvins (unit of absolute temperature). See more information in the Color Quality section.

Color rendering index (CRI) indicates how well a light source renders colors of people and objects, compared to a reference source. See more information in the Color Quality section.

Phosphor conversion is a method used to generate white light with LEDs. A blue or near-ultraviolet LED is coated with a yellow or multichromatic phosphor, resulting in white light. See more information in the Color Quality section.

Lumen depreciation - the decrease in lumen output that occurs as a lamp is operated.

Rated lamp life – the life value assigned to a particular type lamp. This is commonly a statistically determined estimate of average or median operational life. For certain lamp types other criteria than failure to light can be used; for example, the life can be based on the average time until the lamp type produces a given fraction of initial luminous flux.

Conduction – transfer of heat through matter by communication of kinetic energy from particle to particle. An example is the use of a conductive metal such as copper to transfer heat.

Convection – heat transfer through the circulatory motion in a fluid (liquid or gas) at a non-uniform temperature. Liquid or gas surrounding a heat source provides cooling by convection, such as air flow over a car radiator.

Radiation – energy transmitted through electromagnetic waves. Examples are the heat radiated by the sun and by incandescent lamps.

Junction temperature (Tj) – temperature within the LED device. Direct measurement of Tj is impractical but can be calculated based on a known case or board temperature and the materials' thermal resistance.

Heat sink – thermally conductive material attached to the printed circuit board on which the LED is mounted. Myriad heat sink designs are possible; often a "finned" design is used to increase the surface area available for heat transfer. For general illumination applications, heat sinks are often incorporated into the functional and aesthetic design of the luminaire, effectively using the luminaire chassis as a heat management device.

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