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## Use of LED replacement lamps with Litelab fixtures

Litelab has been manufacturing lighting fixtures for over 40 years and a large percentage of them are still in service. The recent change in the market from halogen lamps to LED replacement lamps has created some problems and concerns.

LED replacement lamps can be problematic and subject to having performance and compatibility problems. Much as everyone would like to think they are as simple as replacing a halogen lamp, the reality is very far from that. They are actually a relatively complex electronic system, and compared to dedicated LED fixtures, to fit the size requirements of a lamp, are missing a lot of the electronic circuitry necessary for universal trouble-free performance. The manufacturers all use different internal designs to avoid each other's' patents and all of them are subject to problems with harmonics generated back into the AC line. It is important to confirm with the lamp manufacturer that their specific product is compatible with the fixture, dimmer, electronic transformer, and wiring system in use. **All lamps presently on the market have some limitations as to thermal performance, compatibility with electronic transformers and dimmers, and the maximum number of lamps per circuit under various conditions.**

There are two general conditions, of equal importance, that are of concern when replacing a halogen (or other type of incandescent) lamp with an LED replacement lamp:

- If it is a low voltage lamp (6, 12, or 24 volts AC or DC), will the new lamp work with the existing power supply or electronic transformer and dimming system?
- Will the LED lamp run cool enough to perform to specification and survive to its rated lifespan?

Signs of incompatibility include:

- Flickering or strobing, which may be overt or vaguely visible with peripheral vision
- The electronic transformer or lamp will buzz, hum or otherwise make some noise
- The lamp will not come on at all
- The lamp will not operate at full brightness. This may occur right from turn-on or the intensity may gradually decrease as the lamp warms up.
- Performance problems when dimming
- Shortened lifespan
- Discoloring of optics after some period of operation (this may also be a known defect in some products)



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**Some lamps will flicker, strobe or otherwise perform erratically because there are too many lamps on the circuit, regardless of the presence or type of dimmer or transformer.**

- In some cases, the maximum number of lamps allowed per circuit is very low. Consult the manufacturer's literature for any limitations.
- Some manufacturers require any dimmers used on the circuit to be derated by as much as 75% of full-load rating.
- Some lamps will not perform properly if there are multiple types of lamps, fixtures or loads on the same circuit.

Unfortunately, many brands of lamps are subject to these problems but the manufacturers make no mention of it in the supplied instructions. Where provided by the lamp manufacturer, pay careful attention to all cautions, limitations and other compatibility data, including all fine print and footnotes, and follow the instructions completely. **In any case of the above, the problem is not with the Litelab-supplied equipment.**

**Power supplies and transformers**

Over the years, Litelab has used a variety of transformers and power supplies to operate low voltage lamps. The first generation (1970's until the mid-1990's) products used magnetic transformers. In most cases, LED replacement lamps will work well on magnetic transformers, but the user is cautioned to check the voltage rating of the fixture.

- Many of the fixtures of this vintage used 5.5 volt lamps and the transformer will not properly drive the typical LED replacement lamp rated for 12 volts.
- Some fixtures used a 24 volt transformer, and this will most likely destroy an LED replacement lamp if it is not rated for 24 volts.

From around the mid 1990's until 2014 Litelab used electronic transformers **except for certain proprietary applications extending into the early 2020's which utilized magnetic transformers.** These were designed for a 12 volt halogen lamp with a minimum load of 20 watts. While most LED replacement lamps are significantly less than this, whether or not a specific lamp will work is dependent on the internal circuitry of the lamp. At one point, Litelab kept data on some lamps, but given the vast number of lamps, suppliers and product variations, and complicated by dimming systems which may in and of themselves impact the performance, this is no longer feasible.

- **The user is best advised to obtain a few samples and test them before making a full commitment to a particular lamp. Dimming systems must usually be of the ELV/Electronic low voltage/reverse-phase/trailing edge format or the lamp will not work properly. See lamp manufacturer's specific data.**



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Beginning in 2014, Litelab began phasing in electronic transformers that were specifically designed to operate 12 volt LED replacement lamps (and will also operate a halogen lamp rated up to 50 watts). These electronic transformers are marked with the part number RS12-60LED.

- Dimming systems for these transformers **must** be of the ELV/Electronic low voltage/reverse-phase/trailing edge format.
- Beginning around 2020, an updated version, labeled as RL12-60LED was phased in.

#### **Problems with electronic transformers**

- Flickering and buzzing are a dead giveaway that the electronic transformer does not like either the incoming power or the lamp, but you cannot tell which one by looking at or listening to the fixture. **It is a symptom, not the problem.**
- Based on past history the problem is most likely to be incompatibility with the dimmer system, but the first and easiest thing to do is to confirm the lamps are indeed dimmable. Many replacement lamps are not dimmable or have specific disclaimers regarding the dimming buried in the fine print of the packaging and this should be confirmed by checking the lamps themselves. **Dimming instructions provided with the lamps must be followed exactly.**
- Some companies do not include complete dimming information on their websites or catalog pages, but do incorporate disclaimers or caveats in the fine print on the individual packages.
- **Make certain the dimmer circuit is not overloaded. See the manufacturer's dimmer compatibility instructions. Many lamp manufacturers require the circuit to be derated, in some cases by as much as 75%, or these problems will occur. This is the cause of many complaints.**
- Next, check that the correct dimmer is being used. For Litelab products, it **must** be an electronic low voltage/reverse phase/trailing edge dimmer. **Nothing else will work properly.**
- If the fixtures are on a dimming system that is supposed to automatically sense the style of dimmer to be used, sometimes the automatic sensing does not work and the dimmer needs to be manually programmed to the correct setting. In any case, checking the dimmer is critical.
- Due to a large amount of harmonics generated by these lamps, most dimming system manufacturers and some lamp manufacturers are now either recommending or mandating a neutral line oversized by one gauge.



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- While its occurrence is a rarity and troubleshooting can be time consuming and difficult, a missing or improperly connected neutral (“floating neutral”) may also cause dimming problems. If you have gone through this document and eliminated every other possibility, this is a place to look. A primary symptom of this is that the problem will only be apparent on one or two sections of track, a small portion of a room, or some other relatively small area within the project and the fixtures will work properly when moved to another location, however a change in the load on the circuit may mask the problem. Please consult Litelab if you suspect this may be the problem and our engineers can give you guidance on how to find and repair the problem.

The electronic transformer we use in our current product (Hatch Transformer #RL12-60LED) is specifically designed for use with LED replacement lamps. None of the conditions described above will damage the electronic transformer. **In any case the problem is not with the Litelab-supplied equipment.**

### **Thermal considerations**

LED replacement lamps run much cooler than the halogen lamps they are replacing, but the maximum operating temperatures of these lamps are correspondingly low and they tend to be unforgiving of less-than-optimal operating conditions. There are two basic methods that LED replacement lamps use to dissipate heat:

- Passive heatsinks of various designs
- On-board fans or other method of actively moving air over critical components within the lamp.

There may also be some combination of both. In any case, **it is critical that airflow around or through the lamp and fixture be relatively unrestricted.**

- Some of the older fixtures, with no rear ventilation, limited rear ventilation, or those that tightly surround the exterior of the lamp, may not be suitable for some lamps.
- The use of lenses or other glass or beam-shaping accessories that may limit the airflow through and around the lamp may be additionally detrimental to performance.

The user will need to examine the lamp and the manufacturer’s data and determine where airflow needs to be unrestricted.

- Some will be the entire front
- Some may be the perimeter only
- Some require only that the rear heatsink be unrestricted

The user is also encouraged to look for lamps that are rated for fully enclosed fixtures, although this may not be a 100% reliable indicator as the “standard” fully enclosed fixture used for determining the rating is based on a PAR-38 size lamp and smaller fixtures will not perform as well.



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Typical thermal problems are

- Low output
- Cycling on and off. This may be very rapid or over a long period of time.
- Short product life.
- Discoloration of optical components

Many lamps have internal thermal protective circuits that will either reduce the output of the lamp or turn it off until it cools down, and then turn it back on again.

If, in the case of reduced output, the results are acceptable to the user, this may be a viable solution.

The user is also cautioned that dust and dirt built up on the fixture and the lamp over time will negatively impact the thermal performance of the lamp.

- **It is a good idea to plan on dusting off the lamp's heatsink on a regular basis.**

#### **Summary**

- Any randomly selected off-the-shelf LED replacement lamp may not be suitable for use in older fixtures or with any specific dimming system. The user will need to research and test the desired lamps in their application.
- Unfortunately, many older fixtures and dimming systems were not designed for and cannot be adapted to the current technology.
- It is critical that the correct dimmer (ELV/Reverse-Phase/Trailing edge) be used with Litelab electronic transformers.

While we cannot absolutely guarantee that every lamp by every manufacturer will work well under every circumstance, we presently offer a product line that has been designed specifically around LED replacement lamp technology. Please contact Litelab with questions or for additional information.