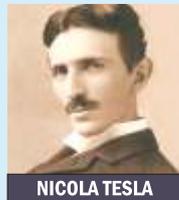


Energy Saving Induction Lamps for Industrial Application

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Induction lights are known as zero maintenance energy savor lights. The Principle of Induction was introduced to the world by the scientist Nicola TESLA in the year 1800's. TESLA once lit 200 lamps without wires from 25 miles away. The electrode less induction fluorescent lamp, more commonly known as an "induction lamp", is based on Faraday's principle of electromagnetic induction and possesses a structure similar to a transformer. The energy is coupled from the primary coils to the secondary ring formed



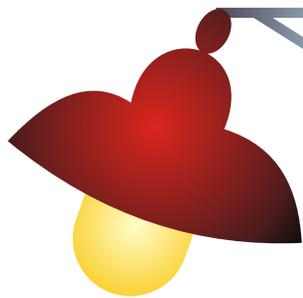
NICOLA TESLA

by plasma, resulting in a high luminous efficient lighting source with a long life span. The innovation is that there is no electrode while the energy is coupled to the lamp through a high frequency induction magnetic field. The buffer gas inside the lamp is excited by the magnetic field and turned into plasma. When the excited plasma atoms return to their ground state, they radiate 254nm UV light, which is converted into visible light by a tri-phosphor coating on the inner glass surface, much in the same manner as fluorescent lamps. This new technology solves the problems associated with electrode-aging, resulting in a maintenance free lamp with a long lifespan.

Nicola TESLA

Induction lamps are still the best-kept secret in the US lighting industry, although they were actually introduced in 1990. It is one of the best technologies developed in recent years. Many builders, architects as well as distributors in lighting industry are still not having knowledge of this product.

Compact fluorescent technology has become much more widely accepted. However its popularity and advantages are growing up and the days are not far when this technology will fully replace the existing one.



Abstract

Induction Lamps are superior over other lamps. Its life is over 20 years and light output maintenance of 90% is even after 20 years of life@12 hours per day. It works with high power factor of 99% where as color radiation index is greater than 90%. Instantaneous starting is a built in feature. These lamps are much superior over Metal Halide or Sodium Vapour lamps. It has zero maintenance cost and energy saving is enormous to the extent of 60%.

Principle of Operation

Electromagnetic transformers, constructed from rings of metal coils and powered by high frequency electronic ballast, create an electromagnetic field around a glass tube which contains the gas. The discharge path, induced by the coils, forms a closed loop allowing acceleration of free electrons, which collide with mercury atoms and excite the electrons. As the excited electrons from these atoms fall back from this higher energy level to a lower stable state, they emit ultraviolet radiation. This UV energy is converted to visible light as it passes through a phosphor coating on the surface of the tube. The unusual shape of an induction lamp maximizes the efficiency of the electromagnetic fields that are generated.

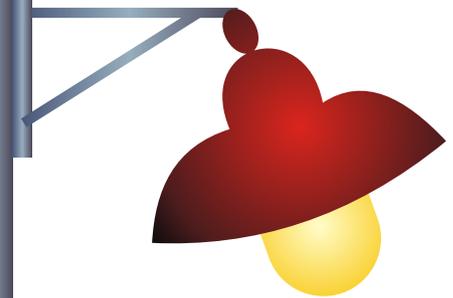
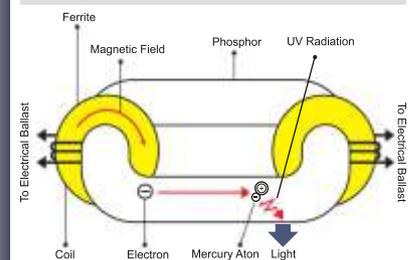


Fig-1: Principle of Operation



Induction lamp uses wireless technology to produce light - using simple magnetism. Energy transmission takes place by way of a magnetic field. Fluorescent lamps use electrodes to strike the arc and initiate the flow of current through the lamp, which excites the gas fill whereas Induction lamps do not use electrodes instead of ballast, the system uses a high-frequency generator with a power coupler. The generator produces a radio frequency magnetic field to excite gas fill and energy transfers through electromagnetic induction. In fluorescents, each time voltage is supplied by the ballast and the arc is struck, the electrodes degrade a little, eventually causing the lamp to fail. Since an induction lamp has no electrodes, it can last up to 100,000 hours (11.4 years non-stop). The ballast connects to main power source and can also be connected to DC sources (like batteries) in an emergency Thanks to high-quality circuits, induction fixtures with integrated ballast can last up to 60,000 hours. The most common lamp looks like an incandescent light bulb, but there's no electrical connection inside the glass.

One 400-w induction lamp saves the

equivalent of: 20 mercury vapor lamps, 25 metal halides, 50 high-power compact fluorescents, 108 T5 fluorescents, 500 T8 fluorescents, 1067 incandescent lamps.

With power ranging from 80 to 400-W, induction lamps can brighten tunnels and high ceilings, Commercial and industrial applications include, warehouses, supermarkets, retail showrooms, gas stations, shopping malls, corridors, parking lots, tennis courts, billboards, street lighting (freeway and highway) airports.

Lamp Life

- **Metal Halide** : 15,000 hours of rated life; color shifting over life of lamp; horizontal operation will reduce lamp life.

- **LPS** : 18,000 hours of rated life; produces monochromatic yellow light; 7-15 minutes to reach full light output.

- **Fluorescent** : 20,000 hours of rated life; will not start in cold temperatures; on/off cycles will degrade lamp life.

- **HPS** : 24,000 hours of rated life; produces a white/yellow light; requires 1 minute cool down before re-strike.

- **Tesla Induction Series** : 100,000 hours of rated life; clean bright white output; no warm up time/instant re-strike; on/off cycles will not reduce lamp life; starts in cold environments

Life of different lamps is shown below. It is evident that induction lamps can be used for more number of hours and in turn life time is comparatively much more than other lamp.

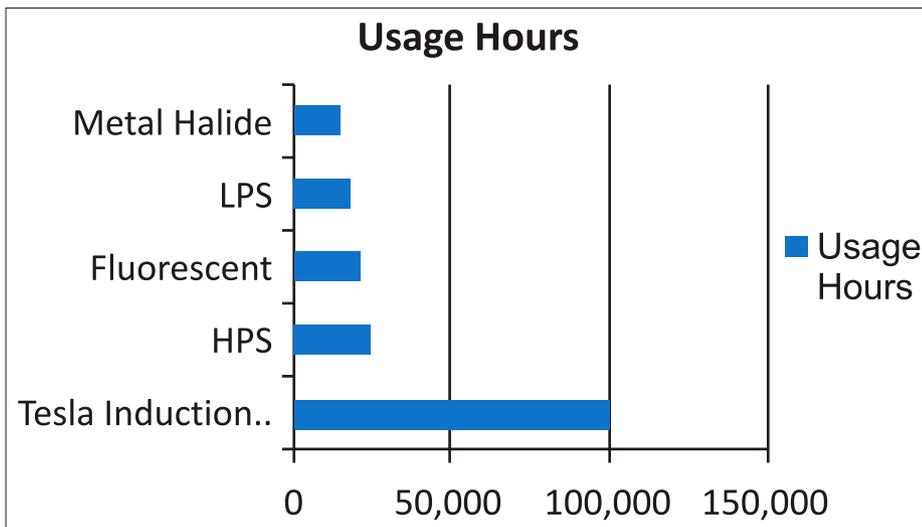
In India 30m High Mast Lighting Project was installed by Applying Hongyuan LVD Induction Lamp on 10.06.2009. 522 Hongyuan LVD Induction Lamp was successfully installed on a trial project of high



Photo 1: 40w Induction Lamp Street Lights In Chennai - in Replacement of 70w MHL



Photo 2 : 120W Induction Lamp Street Lights in Gadag City - in Replacement of 250W HPSV.



mast with pole height 30m and pole distance 45m. The project located on an oil terminal of a famous oil company. Currently the project is now in the evaluation and after that they are going to make suitable recommendations for making LVD induction lighting a part of their future program. Tunnel lighting can be visualized with the photos 3 below with 250W HPSV and 100 W Induction lamps.

Advantages

(a) Long life – Induction lamps have longer life compared to any other lamps. It can glow continuously for 100,000 hours or 20years of life @12 hrs per day.

(b) Temperature – Its igniting temperature is 2,700K-6,500K which is lower than normal lamps.



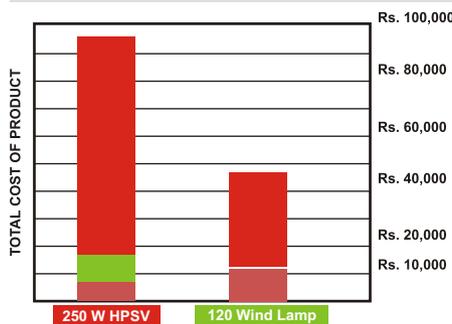
Photo 3 : Tunnel Light 250W HPSV



100W Induction Light

(c) Maintenance costs – go 10 years without a change out. These lamps are although having high initial cost, these can be compensated by low energy consumption and zero maintenance cost. This is shown in the accompanying graph clearly.

Fig. 3 : Energy Replacement Initial Cost



(d) Energy Efficient – These lamps are energy efficient and releases 85+ Lumens per Watt.

(e) Lumen maintenance –Lumen output is maintained throughout life time at 70% of its light output at 100,000 hours.

(f) Instant on capability –These lamps can be used with photocell or motion sensor.

(g) High output – It has got high output i.e. 70W to 400W

(h) No flickering, no Strobing, no noise: While in service these lamps generate no noise, Strobing and Flickering does not occur.

(i) Minimal color shifting: It maintains the original color of the object.

(j) Starting temperatures low –The starting temperature of these lamps are 400 Fahrenheit which is quite low and low temperature

operation makes it suitable for trouble free operation.

(k) Color Rendering: - These lamps offer good color rendering index. It is to the tune of 85%. Hence clear vision and clear picture with color visibility is advantageous. If compared with spectral power distribution, these lamps are excellent.

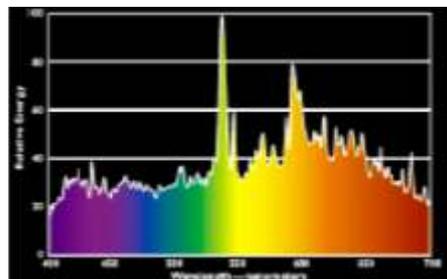
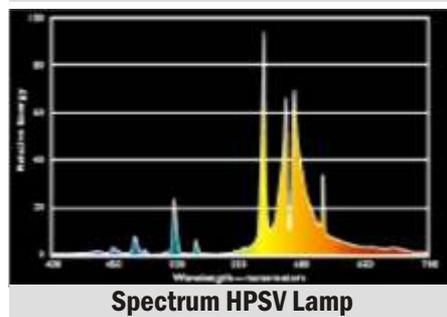


Photo 3 : Spectrum Induction Lamp



Spectrum HPSV Lamp

Disadvantages

(a) While induction lamps can generate more lumens per watt compared to metal halides (80 v. 70), it is not as efficient as T5's that powers 100+ lumens per watt.

(b) 5 to 6 times more expensive than metal halide systems, and also in new fixtures, which can inflate payback periods and reduce return on investment.

However, one will generally get a 30% reduction in capital and operating cost immediately from the reduced number of fixtures made possible by the higher light output. We also get 15% more efficiency just because the induction system is more efficient

Sustainability

- US Lighting Tech estimates that by replacing 10,000, 70W High Pressure Sodium lights with 10,000 40W induction lights, a customer can save approximately \$3.5M over 10 years. That translates into reductions totaling 20 million pounds of carbon emissions or taking 2,700 cars off the road annually.

- A longer rated life means less replacement maintenance and fewer lamps discarded into landfills

- LEDs (sustainable lamps) have same lifespan but they have limited brightness and poor color rendering which means Induction Lighting is not only sustainable but of high quality (also have 2x more light output than LEDs)

(While induction lighting has a higher upfront cost than competing technologies, it is cost competitive over time due to re-lamping, maintenance and energy savings.)

Now a days suppliers are offering different terms of payment and leasing arrangement.

The FCC and CE regulations are in place to protect navigation and radio communications. The system will not interfere with portable or cellular/mobile. The Indo induction lamp can be dimmed by up to 50%. All three components are separately replaceable, however, Indo Induction lights are almost always supplied as a three-component system even for re-lamping. End of life usually means that the generator must be replaced, and at the time, it is usually recommended to replace the bulb, as phosphor degeneration at 100,000 hours lowers lumen output 35% to 40%.

Conclusion

Induction lamps are although costly initially, the cost can be offset by low energy, and maintenance cost. Street lighting and tunnels, or in high ceilings where there is continuous operation, such as hotel rotundas, these lights are better suited. It is better for Cold environments, such as supermarket walk. Reliability, high lumen output and high quality lighting is another attribute in these lamps. In areas that require lamps to reach full illumination immediately, these lamps are better. In coming days, ultimate solution for lightening is Induction Lamps only. The initial cost is now compensated by suppliers either by differed terms of payment or leasing agreement. Induction Lamp helps in environment conservation too.

Acknowledgement

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