

Intro to

Induction Lighting



What is Induction Lighting?

- Also called electrodeless lamp
- a light source in which the power required to generate light is transferred from the outside of the lamp envelope by means of electromagnetic fields, in contrast with a typical electrical lamp that uses electrical connections through the lamp envelope to transfer power.

Source: http://en.wikipedia.org/wiki/Electrodeless_lamp

Induction Lighting offers great benefits for those looking to save energy without a large investment. Also called an electrodeless lamp, induction lighting offers a solution to customers looking for long-life, energy savings and no high-end investment.

There are three advantages of eliminating electrodes:

- Extended lamp life, because the electrodes are usually the limiting factor in lamp life.
- The ability to use high efficiency light-generating substances that would react with metal electrodes in normal lamps.
- Improved collection efficiency because the source can be made very small without shortening life - a problem in electroded lamps

Almost all of the light sources currently in use have one thing in common, metal electrodes sealed into the walls of the bulb to bring the electrical current inside the lamp chamber/envelope.

The main failure mechanisms in these typical lamps with electrodes [other than breakage] is:

Failure of the filament due to depletion of the filament material over time as atoms are stripped off by the electrical current;

- Vibration which breaks the filament, especially when it is hot;
- Failure of the seal integrity of the lamp; typically caused by thermal stresses in the area where the electrodes go through the glass walls. The failure of the seal can either be sudden and complete, or a “slow leak” over time allowing the entry of atmospheric gasses which contaminate the interior.

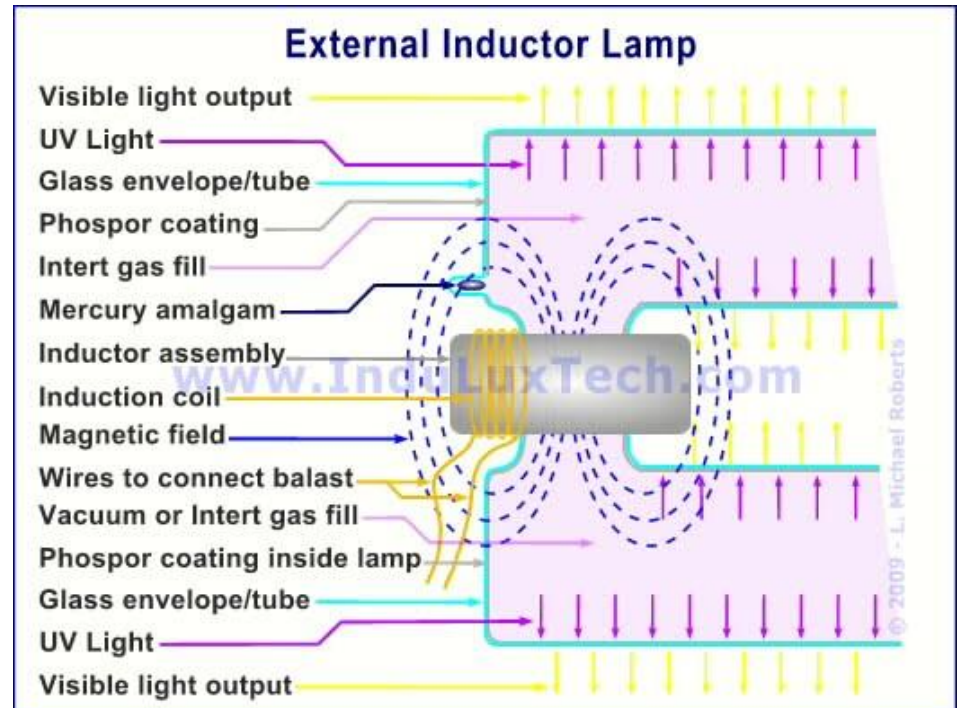
- Magnetic induction lamps are basically fluorescent lamps with electromagnets wrapped around a part of the tube, or inserted inside the lamp. In external inductor lamps, high frequency energy, from the electronic ballast, is sent through wires, which are wrapped in a coil around the ferrite inductor, creating a powerful magnet.



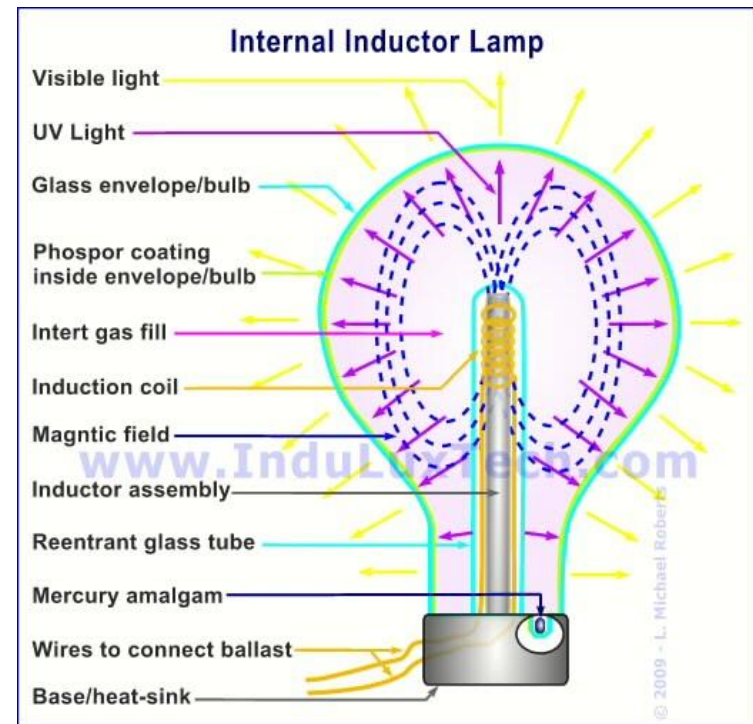
Rectangular and round external inductor lamps



The induction coil produces a very strong magnetic field which travels through the glass and excites the mercury atoms in the interior which are provided by a pellet of amalgam (a solid form of mercury). The mercury atoms emit UV light and, just as in a fluorescent tube, the UV light is up-converted to visible light by the phosphor coating on the inside of the tube. The system can be considered as a type of transformer where the inductor is the primary coil while the mercury atoms within the envelope/tube form a single-turn secondary coil.

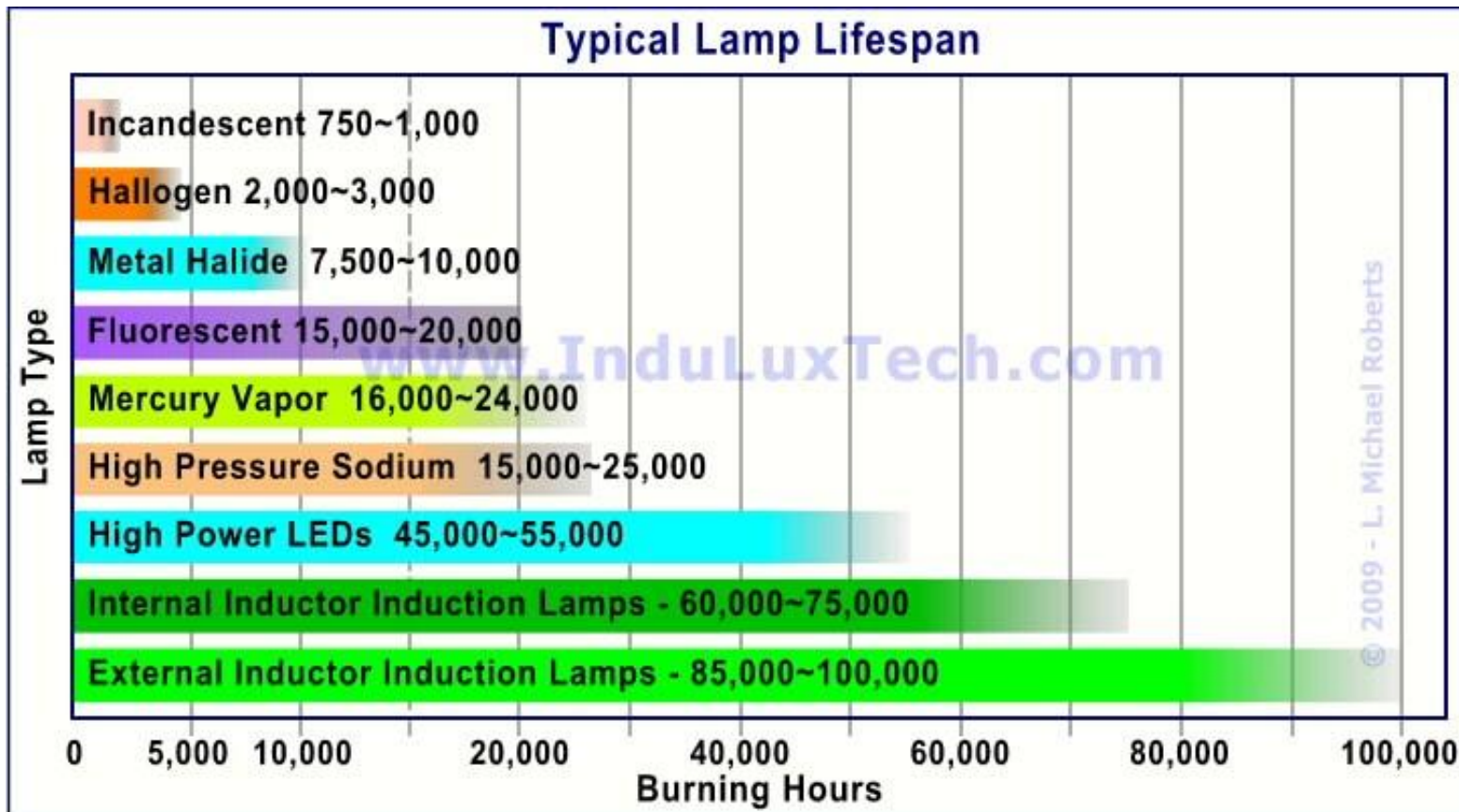


In a variation of this technology, a light bulb shaped glass lamp, which has a test-tube like re-entrant central cavity, is coated with phosphors on the interior, filled with inert gas and a pellet of mercury amalgam. The induction coil is wound around a ferrite shaft which is inserted into the central test-tube like cavity. The inductor is excited by high frequency energy provided by an external electronic ballast causing a magnetic field to penetrate the glass and excite the mercury atoms, which emit UV light, that is converted to visible light by the phosphor coating.



As with conventional fluorescent lamps, varying the composition of the phosphors coated onto the inside of induction lamps, allows for models with different color temperatures. The most common color temperatures of induction lamps are 3500K, 4100K, 5000K and 6500K.

While induction lamp technology has matured in the last few years, is often overlooked or underutilized in lighting applications since none of the major manufacturers promote induction lamps in any significant way. LED lighting seems to get the most “buzz” in the market as LEDs are promoted as the best alternative to conventional lighting due to their longevity. Induction lamps have a lifespan of 80,000 to 100,000 hours (depending on type and model), which is much longer than the typical high-power white LED lamp lifespan which is in the 50,000 to 55,000 range.



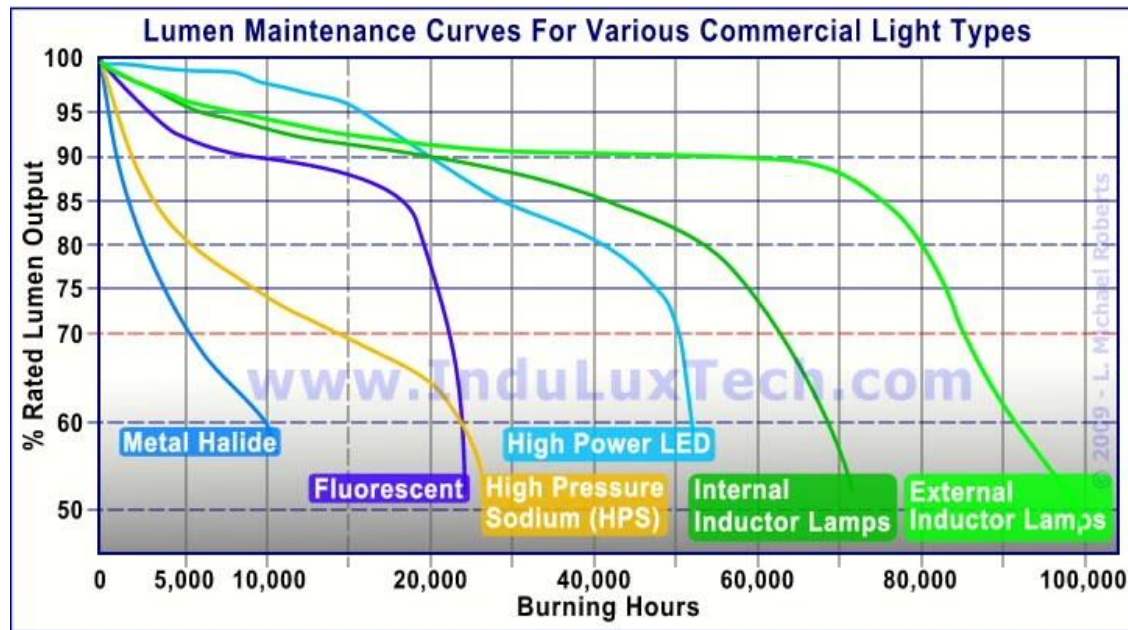
The major difference between the technologies (other than lifespan) is in conversion efficiency (energy utilization) and costs.

Most presently available commercial LED lighting fixtures have conversion efficiencies in the 35 to 60 Lumens/Watt (L/W) range.^[3] LED elements with a conversion efficiency of 70~75 L/W are available, but still quite expensive. There are reports of LEDs with conversion efficiencies of up to 100 L/W operating in research labs, but they are not yet commercially available.

Induction lamps have a conversion efficiency ranging from 65 L/W in low wattage (8 ~ 20 W internal inductor types) to 90 L/W in the high wattage (250 ~ 400 W external inductor models) range.^[3] Ongoing research will see some small improvements in these numbers. When considering commercial/industrial lighting and using a 200 W fixture as an example, the induction lamp version will produce 16,000 Lumens while an LED version would only produce 11,000 Lumens (about 31% less light) with the same energy input.

- Long lifespan due to the lack of electrodes - between 65,000 and 100,000 hours depending on the lamp model
- Very high energy conversion efficiency of between 62 and 90 Lumens/watt
- High power factor due to the low loss in high frequency electronic ballasts which are between 95% and 98% efficient;
- Minimal Lumen depreciation (declining light output with age) compared to other lamp types as filament evaporation and depletion is absent (see graph below);
- “Instant-on” and hot re-strike, unlike most conventional lamps used in commercial/industrial lighting applications (Sodium vapor and Metal Halides);
- Environmentally friendly as induction lamps use less energy, and generally use less mercury per hour of operation than conventional lighting due to their long lifespan. The mercury is in a solid form and can be easily recovered if the lamp is broken, or for recycling at end-of-life

These benefits offer a considerable cost savings of between 35% and 55% in energy and maintenance costs for induction lamps compared to other types of lamps that they replace. In some applications, advanced energy savings technologies incorporated into the fixtures can provide energy savings as high as 75%.



Canopy Fixtures

Small Canopy (C08)

IND / 15 or 23 watts

Medium Canopy (C12)

IND / 40 or 80 watts

Large Canopy (C19)

IND / 80, 120, or 200 watts



C08



C12



C19

Flood Lights

Area Light Architectural (ALA1)

IND / 80, 120 or 150 watts

Large Area Light (ALL1)

IND / 200 watts

Medium Area Light (ALM1)

IND / 80 or 120 watts

Area Lighter Shoebox-Flat Lens (ARSBF)

IND / 200 or 300 watts

Horizontal Flood Light (HFL2)

IND / 40 watts



ALA1



ALL1



ALM1



ARSBF



HFL2

Garage Lights

Round Garage Lighter (RGL)

IND / 40 or 80 watts



Highbays

**Highbay - Acrylic 16"
Open Bottom Reflector
(GHAC16)**

IND / 120 or 150 watts



**Highbay - Acrylic 22"
Open Bottom Reflector
(GHAC22)**

IND / 200, 300, or 380 watts



Roadway Lighting

Roadway Lighting Flat Lens (RL3F)

IND / 80 watts

Roadway Lighter - Flat Lens (RL1F)

IND / 100 Watts



RL3F



RL1F

Wallpacks

Cut-Off Wallpack (CWP)

IND / 15, 23, or 40 watts

Large Deep Wallpack (LDWP2)

IND / 80, 120, or 150 watts

Large Wallpack (LWP2)

IND / 80 watts

Medium Wallpack (MWP)

IND / 40 watts



CWP



LDWP2



LWP2



MWP