Lamp and Ballast Guide

BusinessLights
The Lighting Solution Center

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1.1 Linear Fluorescent

A high efficiency double ended discharge lamp that contains an inert gas and low pressure mercury vapor to produce ultraviolet (UV) energy internally. The UV excites a thin layer of phosphor materials applied to the inside of the of the lamp tube. The phosphors change the UV to visible light.

1.2 Compact Fluorescent Lamp (CFL)

A single ended fluorescent lamp made from smaller size materials to form a compact shape. A CFL typically has an integral ballast and a screw base for easy replacement of incandescent lamps. CFL replacement of an incandescent lamp provides benefits of longer life and energy savings.

2.1 High Intensity Discharge (HID) Lamps

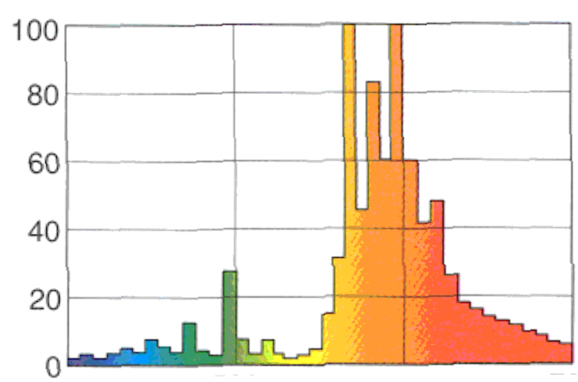
HID Lamps produce a high level of light for the relatively small physical size of the bulb. The light source of an HID Lamp is an "Arc Tube" that consists of two electrodes inside a fused silica or ceramic tube that is filled with gas and metal vapors. A controlled high intensity arc (electrical discharge) is maintained between the two electrodes to produce the light. The different types of HID Lamps and their main benefits and characteristics are as follows:

2.2 Mercury Vapor Lamps (MV)

Originally developed as a more efficient light source than the incandescent light bulb. Mercury Vapor Lamps produce most of their bluish-white light from Mercury Vapor in the arc stream. They feature low cost and long life for landscape, security, and roadway lighting! Mercury Vapor Lamps are the least efficient HID sources at 50-60 LPW. They are available in 40-750 watts with life from 12,000 to 24,000 hours. They must cool 3-6 minutes before restarting. The arc tube material is fused silica.

2.3 High Pressure Sodium Lamps (HPS)

HPS Lamps have an efficiency of 90-140 LPW, very long life at 10,000-40,000 hours, short warm up time (3-4 minutes) and quick restart times. They have excellent lumen maintenance and produce a golden yellow light primarily from sodium vapor in the arc stream. They are typically used for street and parking lot lighting, and some plant growth applications. They are available in 70-1000 watts. The ceramic arc tube is polycrystalline aluminum oxide. Typically in 70-1000 watts.



2.4 Metal Halide Lamps (MH)

MH Lamps produce their light by the arc stream radiation from mercury plus halides of metals such as scandium, indium, dysprosium, and sodium. They have an efficiency of 80-115 LPW and lamp life between 10,000 to 20,000 hours. They are available in a wide range of wattages from 35 to 2000 watts. The arc tube is made from fused silica.

2.5 Types of Metal Halide Lamps

- **Probe Start Metal Halide Lamps** have an additional electrode that assists the ballast in starting the lamp.
- **Pulse Start Metal Halide Lamps** have improved lumen maintenance and higher mean lumen ratings than standard Metal Halide Lamps. They operate on ballasts that have high voltage igniters to help start the lamp and reduce restart time. The arc tube is shaped fused silica.
- **Ceramic Metal Halide Lamp** uses a ceramic material (polycrystalline aluminum oxide) for the arc tube (instead of fused silica).This results in better color rendering (780 CRI) and improved lumen maintenance over the life of the lamp. The improved (consistent) light output and color control lends itself to applications where light quality and consistency are very important such as retail and grocery applications. Ceramic Metal Halide Lamps have life up to 20,000 hours, wattages of 20-400 watts, and 80-100 LPW efficiency.

2.6 HID Ballasts and Types

HID Ballasts provide the lamps with the proper starting voltage and limit the operating current once the lamp is started. HID lamps have negative impedance which means they draw more electrical current than they need to maintain an ignited arc stream. Without the current-limiting ballast, HID lamps would self-destruct in a very short time. HID ballasts are classified by the type of circuits they use:

- **Electromagnetic: Reactor (R)**
- **Electromagnetic: High Resistance Auto Transfer (Hx)**
- **Electromagnetic: Constant Wattage Transformer (CWA)**
- **Electromagnetic: Magnetic Regulator**
- **Electronic: Electronic Low Frequency Square Wave**

2.7 Electromagnetic Ballasts

- **Electromagnetic Ballasts** use an induction coil to achieve high starting voltage and to limit the current. However the inductor causes a waveform shift and an inefficient power factor. A capacitor is used to correct the phase shift.
- **Reactor Ballasts** are the simplest, most efficient, and lowest cost electromagnetic ballasts. Reactor Ballasts use line voltage and an igniter device to start the lamp.
- **High Reactance Autotransformer Ballasts** are the 2nd low cost choice when line voltage is insufficient to start the lamp. Hx Ballasts use a two induction coil (transformer) design to step up the starting voltage.
- **Constant Wattage Autotransformer Ballasts** are the most popular HID Ballasts at economical cost. They provide stabilized (lamp regulation) light output compared to standard magnetic ballasts. The circuit consists of a transformer with a capacitor in series with the lamp to achieve high power factor, lower drop out voltage, and better light output control when supply voltage variation occurs. They are more expensive than reactor and Hx types.
- **Magnetic Regulator Ballasts** use a transformer with separate coils to increase power factor and to regulate current. The lamp starting circuit uses an igniter and is isolated from the power supply. Magnetic Regulator types are more expensive than constant wattage autotransformer ballast but large changes in input voltage cause very small changes in lamp wattage and therefore very good control over light output.

2.8 Electronic Ballasts

Electronic Ballasts use sold-state (transistor) components to start and operate lamps. They often use integrated circuits for better control and safety features. They are typically more efficient than electromagnetic ballasts and feature small size, lighter weight, improved lumen maintenance, and better color consistency.

Costs of Electromagnetic Ballasts are comparable to Magnetic Regulator Ballasts