



# Product Training Overview

## Definitions

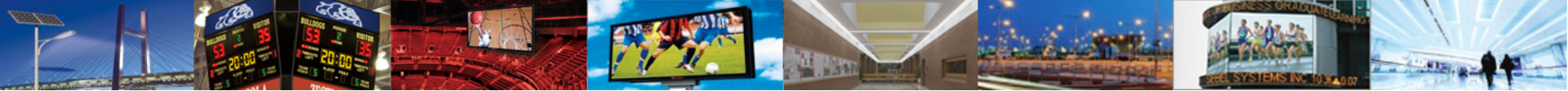
**Watt:** The unit of electrical power as used by an electrical device during its operation. Many lamps come with rating in watts to indicate their power consumption. A light source with a higher lumen per watt value is more efficient.

**Lumen:** Unit of measure used to signify the total amount of visible light emitted by a source, where increased brightness is associated with a higher number.

**Kwh:** A measurement of wattage, where one kilowatt is equal to one thousand watts.

**Color Temperature:** The description used to describe the effect of heating an object until it glows incandescently, the emitted radiation, and apparent color, changes proportional to the temperature; easily envisioned when considering hot metal in a forge that glows red, then orange, and then white as the temperature increases.

**Kelvin:** Unit of measurement for temperature. The Kelvin scale is absolute, thermodynamic temperature scale, starting at absolute zero- the temperature at which all thermal motion ceases.



**Fixture:** an electrical device used to create artificial light by use of an electrical lamp

**Housing:** protective cover designed to contain or support a mechanical device

**Foot Candle:** Unit of light intensity falling onto a surface. One foot-candle is the illuminance of one candle on a surface from one foot away.

**Retrofit** is the process of adding new technology or features to an existing system. Specifically, a fluorescent retrofit kit is a bundled set of hardware that is designed to increase the efficiency and performance of an existing fluorescent fixture.

**Retrofit Kit:** this includes brackets, sockets, screws, and quarter-turn fasteners. Most kits also include a reflector, which is designed specifically for the kit in order to effectively direct light out of the fixture and “land” the light where it is needed. Ballasts and bulbs are generally sold separately.



**Spec Sheet:** Provide detailed information on wattage, life hours, voltage, color temperature and more. In many cases, a single specification sheet may be related to a number of different products.

**Rated Life:** A light bulb's estimated lifetime measured in hours. For all light bulbs, lifetime is determined by operating a sample of bulbs according to industry test standards. The time that half of the test sample fails is considered rated life

**Color Rendering Index:** The calculated rendered color of an object. The higher the CRI (based upon a 0-100 scale), the more natural the colors appear. Natural outdoor light has a CRI of 100. Common lighting sources have a large range of CRI. For example: Cool White CRI = 62 Luxeon CRI = 70 Vita-Lite CRI = 91

**Energy Star:** is an international standard for energy efficient consumer products originated in the United States of America.

**UL:** World's largest, not-for-profit product safety testing and certification organization with global name recognition



## Types of Conventional Lighting

Incandescent

Fluorescent

Compact Fluorescent (CFL)

Metal Halide

High Pressure Sodium

HID

Halogen

Mercury Vapor



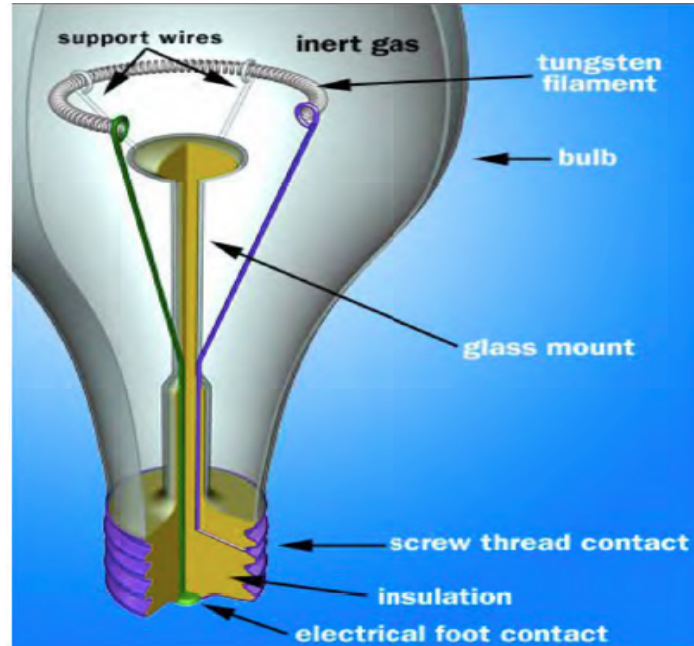
## Incandescent

**Definition:** Produces light by heating a filament wire to a high temperature until it glows. Incandescent bulbs require no external regulation equipment, and are widely used for household and commercial lighting.

**Application:** Widely used in domestic applications, such as table lamps, car headlamps, and electric flashlights.

**Wattage Range:** 1.5- 300 watts

**Major Drawbacks:** Convert less than 5% of the energy they use into visible light. Easily breakable, hot to touch, requires 400-1000% more wattage than comparable LED lighting





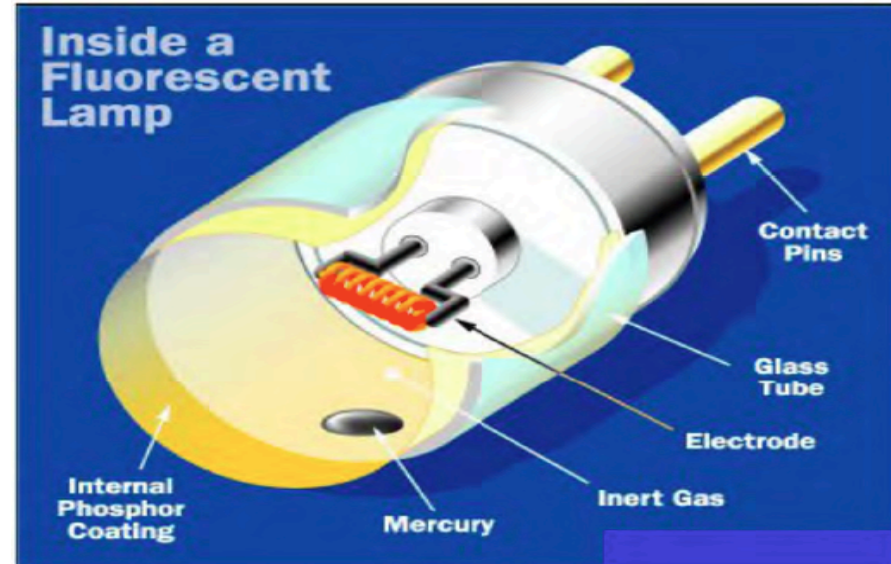
## Fluorescent

**Definition:** A gas-discharge light tube that uses electricity to excite mercury vapor, producing visible, short-wave ultraviolet light.

**Application:** Fluorescent bulbs are meant to replace incandescent bulbs, utilizable in a wide variety of areas

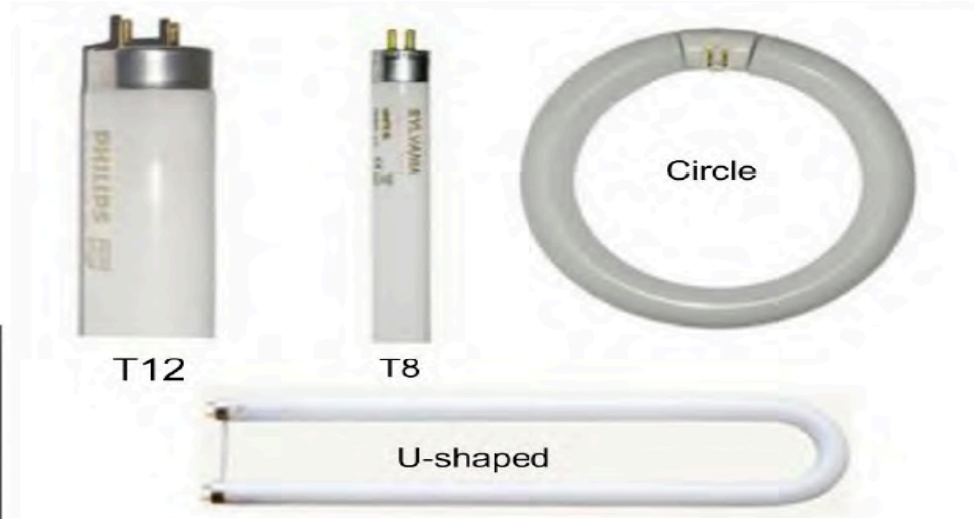
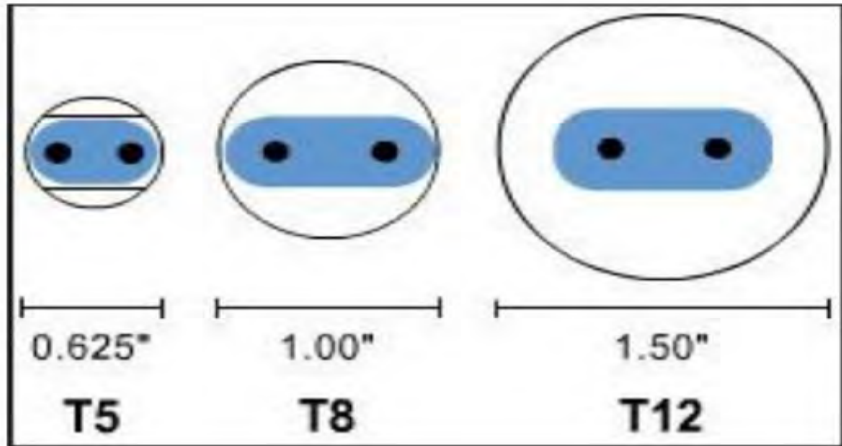
**Wattage Range:** 40-500 watts

**Major Drawbacks:** Contain mercury which makes it difficult to dispose of and the quality of light is often duller and more yellowed.





## Fluorescent







## Compact Fluorescent

**Definition:** These lights use a tube which is curved or folded to fit the shape of an incandescent bulb, and have a compact electronic ballast in the base of the lamp. They contain mercury which complicates their disposal.

**Application:** Are created to replace incandescent bulbs and have a higher purchase price.

**Wattage Range:** 9-52 watts

**Major Drawbacks:** Contain cancer causing chemicals including mercury, which is difficult to dispose of.





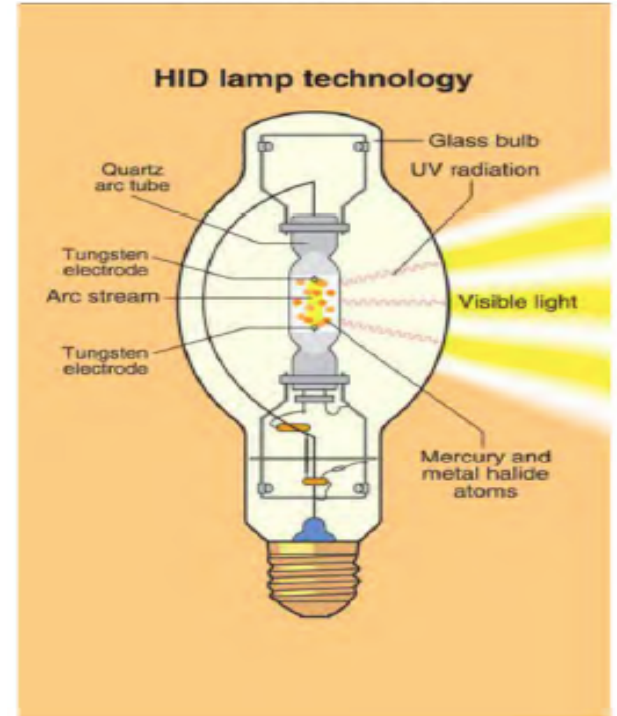
## HID

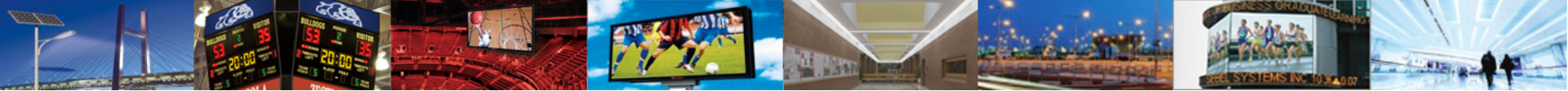
**Definition:** A type of electrical lamp which produces light by means of an electric arc between tungsten electrodes housed inside a translucent arc tube. HIDs make more visible light per unit of electric power consumed than fluorescent and incandescent lights because a larger proportion of their radiation is visible light, as opposed to heat.

**Application:** High levels of light over large areas are required, and when energy efficiency and/or light intensity are desired - gymnasiums, warehouses, football stadiums.

**Wattage Range:** 11-1001 watts

**Major Drawbacks:** Inefficient, produce UV, easily broken



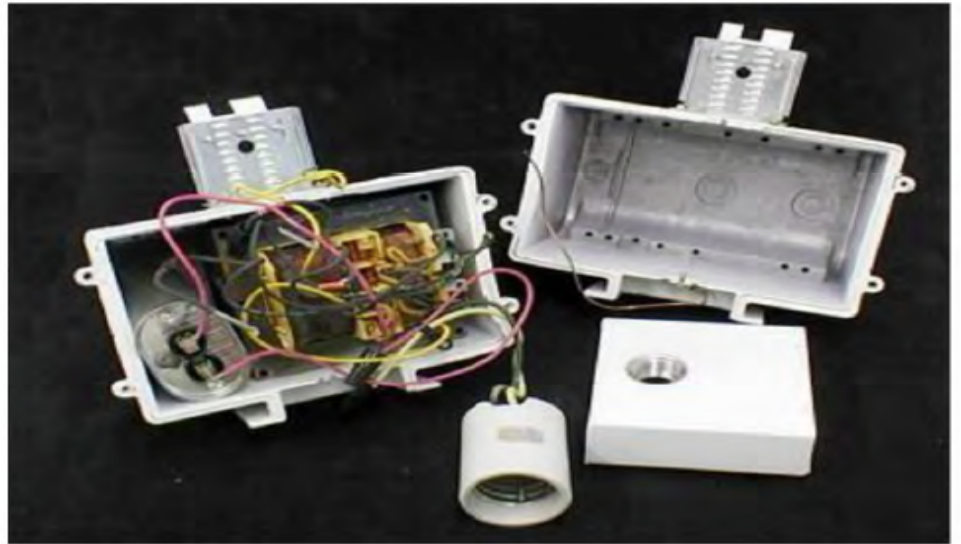


## HID





## HID





## Metal Halide



**Definition:** Part of the HID family of lamps, Metal Halide lamps produce high light output for their size, making them a compact, powerful, and efficient light source. By combining metals to mercury vapor lamps, improved luminous efficacy and light color is achieved.

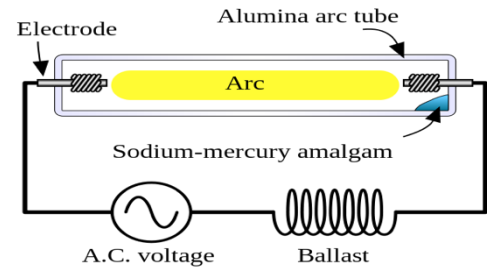
**Application:** Used both for general lighting purposes indoor and outdoor, automotive and specialty applications.

**Wattage Range:** 100, 150, 250, 400, and 1000 watt versions.

**Major Drawbacks:** As the lamp gets older, maintaining the voltage becomes more difficult, which can cause the arc to fail. In rare occurrences the lamp can explode at the end of its useful life.



## High Pressure Sodium



**Definition:** Light bulb format for halogen bulbs. Lamps are designated by symbols such as MR 16 where the diameter is represented by numerals. Common sizes for general lighting are MR 16 and MR 11.

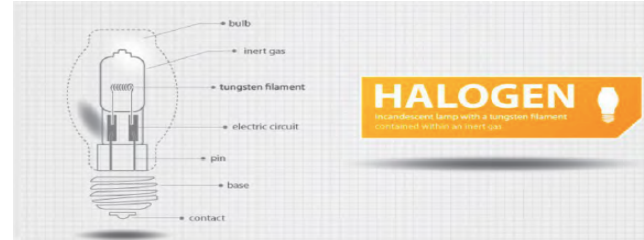
**Application:** These work well for a variety of applications that require directional lighting of low to medium intensity, like track lighting, recessed lighting, desk lamps, pendant fixtures, landscape and retail display lighting.

**Wattage Range:** 35-1000 watts

**Major Drawbacks:** Towards the end of their life, high-pressure sodium lamps lose sodium in the arc and more voltage is required to maintain arc discharge.



## Halogen



**Definition:** An incandescent lamp that has a small amount of a halogen such as iodine or bromine added. The combination of the halogen gas and the tungsten filament produces a halogen cycle chemical reaction that redeposits evaporated tungsten back on the filament, increasing its life and maintaining the clarity of the envelope. They are extremely hot to touch.

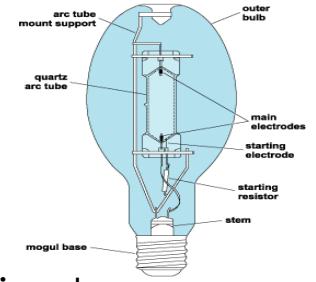
**Application:** Automotive, architectural, home use, stage lighting, and more.

**Wattage Range:** Depending on lamp type - 5 watt to 1500 watts.

**Major Drawbacks:** Burn hotter than standard incandescents, the outer shell can break which can cause the inner bulb to explode if moisture hits it.



## Mercury Vapor



**Definition:** A gas discharge lamp that uses an electric arc through vaporized mercury to produce light. The arc discharge is generally confined to a small fused quartz arc tube mounted within a larger glass bulb.

**Application:** Large are overhead lighting, such as factories, warehouses, and sports arenas as well as for streetlights.

**Wattage Range:** 35-65 watts

**Major Drawbacks:** They require special fixtures and an electrical ballast. They also need a warm-up period of 4-7 minutes to reach full light output.





## Ballast



**Definition:** A device used to provide the starting voltage or to stabilize the current in a circuit.

**Application:** Ballasts can be as simple as a series resistor, or inductor, capacitors, or a combination thereof or as complex as electronic ballasts used with fluorescent lamps and HIDs.

**Wattage Range:** 26 - 2000 watts

**Major Drawbacks:** Does not directly measure energy efficiency.



## Ballast For Fluorescent And HID Lamps





## Ballast For Fluorescent Lamps





## Light Emitting Diode





## Fixture

Definition:  
 Something attached as a permanent appendage, apparatus, or appliance.



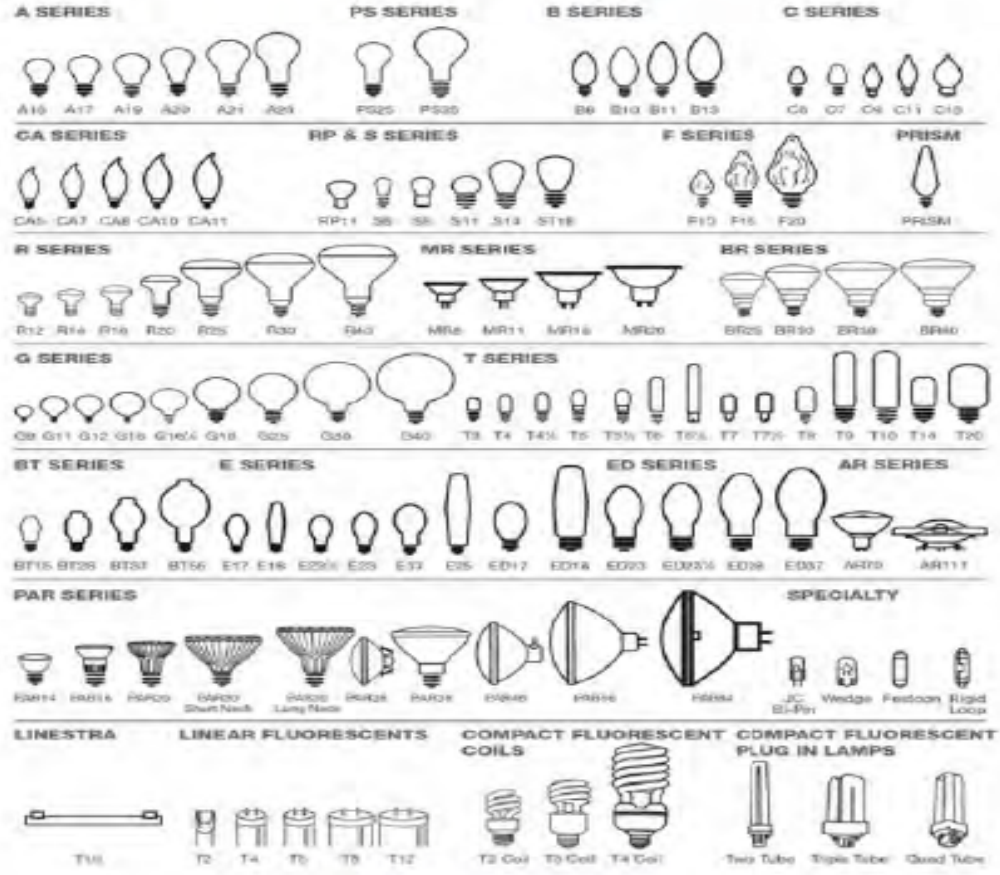


## Lamp





# Lamp Types





## Base

Light bulb base types are typically measured by type and diameter, which is expressed in millimeters. As an example, the typical Edison style medium screw in bulb base that is 26 millimeters in diameter is expressed as an E26 base, LED bi-pin bases, like a fluorescent tube replacement or a bi-pin MR16, the millimeter distance is expressed as the distance between the two pins on the connection. Below are the common letter formats that represent the shape or form of the base. In all circumstances, the numbers following the base shape designation letter are expressing either the width of the base or the distance between the pins on that base, in millimeters:

- B Bayonet Collar Base
  - E Edison Screw Light Base
  - F Single Pin Type Base
  - G Multiple Pin Type Light Bulb Base
  - K Cable Connections
  - P Pre-focused Light Base
  - R Recessed Contact(s) Base
  - S Shell-type Light Bulb Base
  - T Telephone Slide Base
  - W Wedge Base
  - X Special Type Light bulb Base
- Lamp Number of Pin or Contacts
- s Single Pin
  - d Double or Bi-Pin Base Type
  - t Triple Pin Base or Tri-Pin Base or 3 Pin Base
  - q Quadruple Pin Base or 4 Pin Base





# Base Types

## SCREW BASES



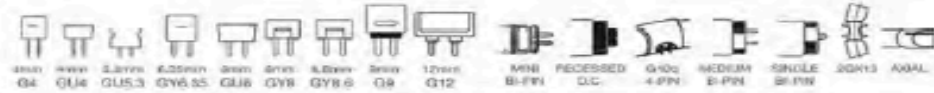
## TWIST & LOCK BASES

## SPECIALTY BASES



## BI PIN BASES

## FLUORESCENT PIN BASES



## COMPACT FLUORESCENT PLUG IN LAMP BASES



## FILAMENTS

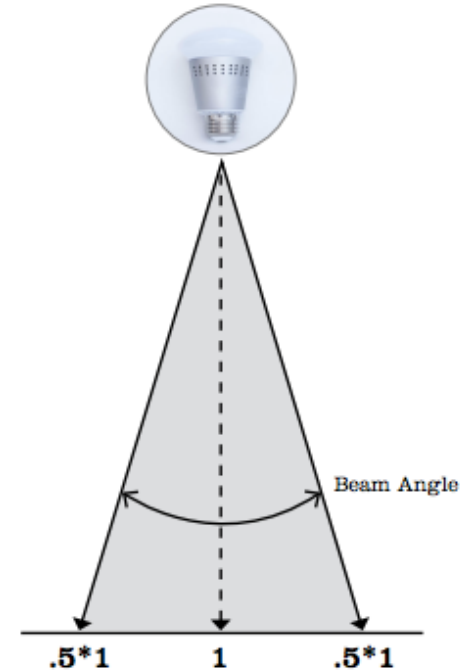
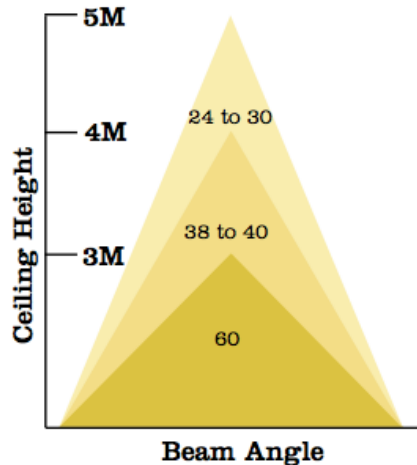


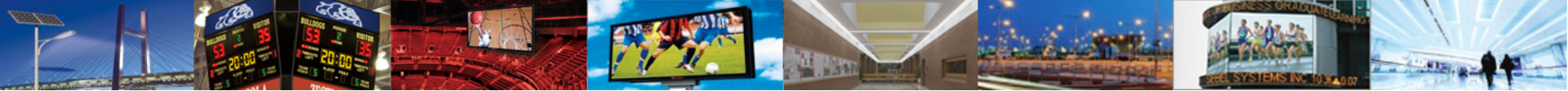
**NOTE:**  
 C (coiled) - Filament wire is wound into a helical coil or is deeply fluted.  
 CC (coiled coil) - Filament wire is wound into a helical coil and this coiled wire is wound again into a helical coil.



## Beam Angle

A beam angle is measured in degrees, and that refers to the width at which the light emanates from the bulb. The angles vary considerably depending on the type and style of the bulb you are using. Beam angles can be as low as 6-8 degrees to produce a precise spot of light to the 100 degree plus beams for very general floodlighting.





## Beam Angle

LED lamps will often come with a wide variety of descriptions for the beam angle. For example, a wide beam angle ‘floods’ an area with light, therefore they are designated as flood lights. The lighting source with a more narrow beam angle is focusing the light on a particular location, or spot, which designates them as spot lights. There is not a consistent usage or standard among LED lighting manufacturers in their designation of beam angles, therefore it is important to consult with your TL Energy consultant to ensure you are getting the proper lighting for your applications.

Code	Typical MR16 Beam Angles	Typical PAR Beam Angles	Description
VNSP	<7 degrees	<15 degrees	Very narrow area
NSP	5-15 degrees	15-30 degrees	Narrow area
SP	16-22 degrees	30-60 degrees	Spot
NFL	23-32 degrees	60-90 degrees	Narrow flood
FL	32-45 degrees	90-120 degrees	Flood
WFL	45-60 degrees	120-160 degrees	Wide flood
VWFL	60+ degrees	>160 degrees	Very wide flood



## Color Rendering Index

Definition: The calculated rendered color of an object. The higher the CRI (based upon a 0-100 scale), the more natural the colors appear. Natural outdoor light has a CRI of 100. Common lighting sources have a large range of CRI.

For example: Cool White CRI = 62 Luxeon CRI = 70 Vita-Lite CRI = 91

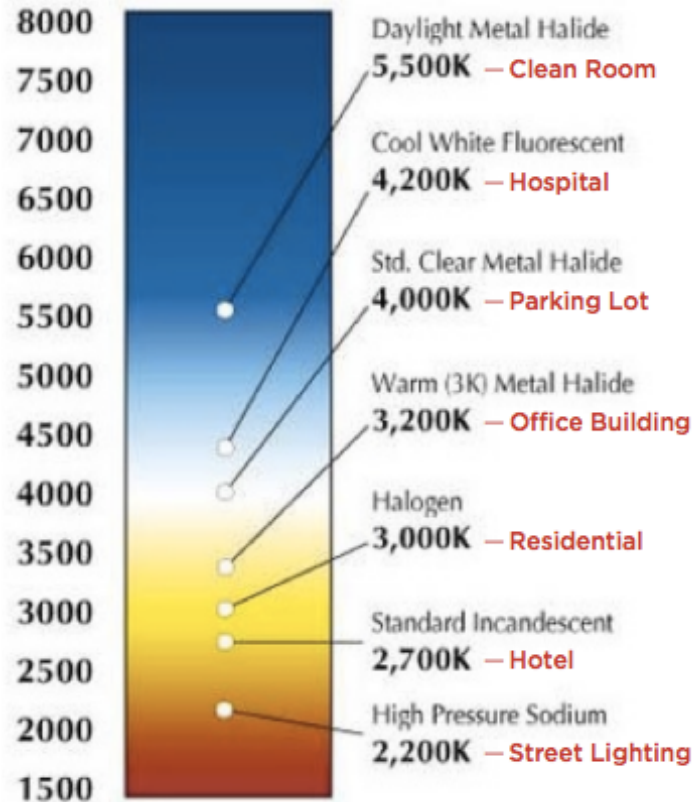
Light Source	Color Temperature	Rendering Index
Candle	the total power of light: visible and non-visible light	100 CRI
High Pressure	2100K	25 CRI
Incandescent	2700K	100 CRI
Tungsten Halogen	3200K	95 CRI
Tungsten Halogen	3200K	62 CRI
Clear Metal Halide	5500K	60 CRI
Natural Sunlight	5000-6000K	100 CRI
Daylight Bulb	6400K	80 CRI



## Color Temperature

### Definition:

The description used to describe the effect of heating an object until it glows incandescently, the emitted radiation, and apparent color, changes proportional to the temperature; easily envisioned when considering hot metal in a forge that glows red, then orange, and then white as the temperature increases.





## Color Temperature

Name of White	Comparable to a:	Kelvin Color Temp.
<b>Warm White</b>	typical incandescent light bulb	2700-3500K
<b>Natural White</b>	typical retail space with fluorescent lighting	4000-4500K
<b>Day/Daylight White</b>	used for high color definition typical noon day sun in many parts of the world	5000-6000K
<b>Cool/Commercial</b>	used in many industrial and commercial applications like hospitals	6000-7000K



## Certifications

Design Lights Consortium (DLC) is a collaboration of utility companies and regional energy efficiency organizations committed to raising awareness of the benefits of lighting in commercial buildings.



**UL mark:** Underwriters Laboratories Inc. (UL) is a U.S. privately owned and operated, independent, third party product safety testing and certification organization. UL develops standards and test procedures for products, materials, components, assemblies, tools and equipment, chiefly dealing with product safety. The UL marking is required for sale for all "corded" electrical devices, and a variety of other equipment.



**CE mark:** The CE marking, that of European Conformity is one of the most common product markings. In the European Union this marking is required for sale of a variety of product categories. An excellent listing of those categories appears here. The permission to use this marking on your product is granted only by an EU recognized "Notified Body". These Notified Bodies are generally product lab testing companies, such as Intertek or SGS. The process requires you to prepare a "Declaration of Conformity", and related paperwork providing the specs of your product.



**FCC mark:** The Federal Communications Commission (FCC) requires all commercial electronic devices to comply to this norm if they employ clocks or oscillators, operate at a frequency of greater than 9 kHz, and use digital techniques. This includes almost every product that contains a micro-processor. Class A Device: Industrial or business use, not intended for public or private use. Class B Device: Public and private use; devices like computers, printers, radios, many electronic toys, etc.



**ETL mark:** The ETL mark is alternative to the UL and CSA marks in the USA. This mark is issued by the Intertek company, with various offices around the world. This mark shows that your product meets all the appropriate safety and performance specifications for your market of sale (generally identical to the standards set by UL and CSA).



**CSA mark:** The Canadian Standards Association (CSA) is a nonprofit association serving business, industry, government and consumers in Canada and the global marketplace. Information on how to obtain the CSA mark for your product can be found on the CSA Website at: <http://www.csa-international.org/>