
6.2 Luminaires

A luminaire is the lighting industry's term for light fixture. A luminaire consists of the housing, power supply (including ballast or transformer), lamp, reflector, and in some cases a lens. A lamp is the lighting industry's term for a light bulb. Luminaires can be designed to be recessed into the ceiling, suspended by a rod, cable, or chain, surface mounted on the wall or ceiling, or attached to a cabinet. Portable table and floor lamps are also classified as luminaires, but they are not covered by the Residential Lighting Standards. Every installed luminaire shall be classified as either high efficacy or low efficacy for compliance with the Residential Lighting Standards. The rules for classifying a luminaire as high efficacy are explained further in Sections 6.2.1 and 6.2.3.

6.2.1 High Efficacy Luminaires

§150(k)1

High Efficacy Luminaire. A high efficacy luminaire is one that meets the efficacies listed in Table 150-C of the Standards (shown as Table 6-1 and Table 6-2 in this chapter), contains only high efficacy lamps or high efficacy LED lighting, and must not contain a socket which allows any low efficacy lighting system to be used. For example, any luminaire containing a medium screw base socket is classified as low efficacy, regardless of the type of lamp installed into that socket.

Typically, high efficacy luminaires contain pin-based sockets, like compact fluorescent or linear fluorescent lamp sockets, though other socket types such as screw sockets specifically rated only for high intensity discharge lamps (like metal halide lamps) light emitting diode (LED) luminaires (dedicated LED lighting fixtures that cannot use incandescent or any other type of lighting technology) may also qualify as high efficacy. Additional information about qualifying HID luminaires or LED lighting as high efficacy is discussed below.

High Intensity Discharge (HID) lighting is primarily used in nonresidential applications. It is most often used for street, parking lot, indoor warehouse, and retail display lighting. When HID lighting is used for residential applications, it is typically used outdoors. Two types of HID lighting are high pressure sodium, which gives off an amber color light, and metal halide, which gives off a cool white light. The Residential Lighting Standards do not disallow HID lighting to be used indoors, but this technology is typically considered too bright for residential indoor use, and currently, the technology requires significant warm up time before reaching full light output.

Exception 1 to §150(k)2A

HID luminaires containing factory installed ballasts and HID rated medium screw base sockets may be classified as high efficacy luminaires provided they meet the efficacies listed in Table 150-C of the Standards (shown as Table 6-1 and Table 6-2 in this chapter).

Exception 1 to §150(k)1

An HID luminaire rated for use only with a HID reflector lamp shall have a minimum lamp efficacy within 2 lumens per watt of the minimum lamp efficacies in Table 150-C.

Induction Lighting combines induction and gas discharge lighting technologies, mostly used as an alternative to outdoor HID lamps. Induction lamps do not contain electrodes, and the lighting system is comprised of three components; a generator, power coupler, and the lamp. Induction lamps have relatively long lives.

GU-24. A relatively new type of line-voltage socket is the GU-24. The definition of GU-24 is in §101. Compact fluorescent lamps and LED lamps have recently been introduced into the market with GU-24 bases.

Exception 2 to §150(k)2A

A luminaire with a line-voltage socket is classified as low efficacy according to the Residential Lighting Standards; however, there is an exception which allows luminaires with a GU-24 socket to qualify as high efficacy. A luminaire with a factory installed GU-24 lamp holder may be classified as high efficacy provided that it meets all of the following requirements:

1. The luminaire is not a recessed downlight rated to be used with a compact fluorescent lamp; and
2. The luminaire does not contain any other type of line-voltage socket or lamp holder (for example, the luminaire cannot use any screw-based lamps, including screw-based incandescent, screw-based fluorescent, or screw-based LED lamps); and
3. The manufacturer does not make available adaptors or other modular components for the luminaire which will convert the GU-24 lamp holder to any other type of socket or lamp holder; and
4. The luminaire is rated for use only with high efficacy lamps or a high efficacy LED lighting source system, according to Table 150-C of the Standards (shown as Table 6-1 and Table 6-2 of this chapter).

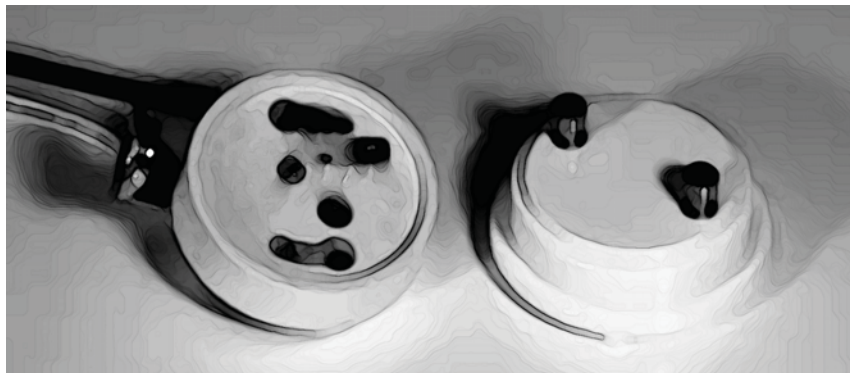


Figure 6-1 – GU-24 socket and base

§119(m); Table 150(c)

LED Certification Requirements. Light emitting diode (LED) lighting may qualify as either high efficacy or low efficacy. To qualify as high efficacy, an LED lighting source system, including fully integrated LED luminaires and LED trims, must be certified to the Energy Commission. Additional information about certifying LED luminaires to the Energy Commission is in Section 6.2.9. For additional information about LED lighting see Section 6.2.10.

§130(d); §150(k)1; Table 150-C

High Efficacy LED Trims. The two most common types of LED lighting available today are fully integrated LED luminaires, and LED “trims.” There are also a few screw-based and pin-based LED lamps (bulbs) available, such as PAR and BR style LED lamps, as well as MR-16 style LED lamps. However, because these LED screw-based and pin-based lamps are interchangeable with low efficacy lamps, they do not qualify a luminaire as high efficacy for compliance with the Residential Lighting Standards.

An LED trim is a one-piece integral unit containing the power supply, transformer, heat sink, and LED circuit board, which is designed to be installed into recessed luminaire housings.

Many manufacturers of LED trims do not manufacture their own luminaire housing, but rather install their LED trims into luminaire housings manufactured by another company. These third-party luminaire housings are typically classified as low efficacy according to Residential Lighting Standards.

Following is an alternate method, approved in accordance with §130(d), for determining the wattage of LED trims. This method for classifying LED trims as high efficacy applies only to LED trims, and shall not be applied to determining wattage for compact fluorescent or other lighting technologies.

The installation of an LED trim may be classified as a high efficacy luminaire provided that all of the following conditions are met:

1. The LED trim shall be certified to the Energy Commission as high efficacy according to Table 150-C of the Standards (shown as Table 6-1 and Table 6-2 of this chapter). Additional information about certifying LED lighting as high efficacy is in Section 6.2.9; and
2. The LED trim shall be hardwired directly to the luminaire housing. The wiring assembly may include a mid-line connector between the LED trim and the wire ends. The mid-line connector may be a GU-24, or other type of connector, but is shall not include a screw-base socket configuration; and
3. The luminaire housing shall not contain a screw-base socket; and
4. Screw-base adaptors shall not be used, even if the manufacturer considers them to be “permanent”; and
5. If the LED trim provided by the manufacturer has a screw-base attached to the end of a “pig-tail”, the screw-base must be cut off and discarded prior to hard wiring the trim directly into the luminaire housing. However, check any UL restrictions on such modifications.

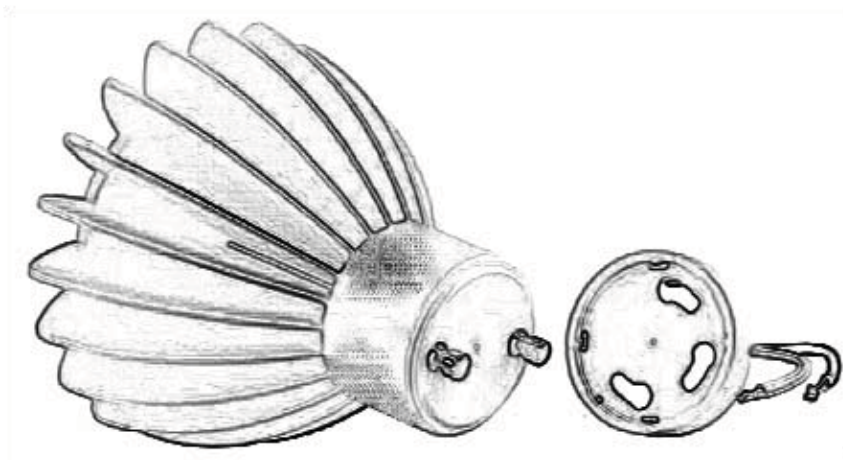


Figure 6-2 – One type of LED trim with GU-24 base

§101 definitions

Hybrid LED Luminaire. A hybrid LED luminaire contains an LED source system as well as another type of light sources, such as incandescent or fluorescent lighting system. A hybrid LED luminaire is defined as a complete lighting unit consisting of a light source and driver together with parts to distribute light, to position and protect the light source, and to connect the light source to a branch circuit. The hybrid LED luminaire is intended to be connected directly to a branch circuit.

§150(k)1; Table 150-C

When an LED source system has been certified to the Energy Commission as high efficacy, and the other light source in the hybrid luminaire also qualifies as high efficacy according to Table 150-C of the Standards (shown as Table 6-1 and Table 6-2 of this chapter), the entire luminaire may be classified as high efficacy for compliance with the Residential Lighting Standards.

Exception 2 to §150(k)1

However, when a high efficacy LED source system is combined with a low efficacy lighting system in a Hybrid LED Luminaire, the high efficacy and low efficacy lighting systems shall each separately comply with the applicable requirements of §150(k).

§119(n)

Ballast for Recessed Luminaire Certification Requirements. Ballasts for a compact fluorescent lamp installed in a residential recessed luminaire shall be certified to the Energy Commission. Ballasts which have not been certified to the Energy Commission shall not be used in residential recessed luminaires. Additional information about certifying to the Energy Commission is in Section 6.2.9.

6.2.2 Low Efficacy Luminaires

§150(k)2

A low efficacy luminaire is any luminaire that does not qualify as high efficacy; or any of the following lighting systems, regardless of efficacy:

1. Contains any type of line-voltage socket or lamp holder, including conventional medium screw-base sockets, candelabra sockets, pin-based sockets, or any other type of line-voltage lamp holders capable of accepting an incandescent lamp or any other type of low efficacy lamp. However, under certain conditions (described in Section 6.2.1) a luminaire with a GU-24 line-voltage socket may be classified as high efficacy.
2. Low voltage incandescent lighting.
3. Track lighting of any type, or any other lighting systems which allows the addition or relocation of luminaires without altering the wiring of the system.
4. Lighting systems which have modular components that allow conversion between screw-based and pin-based sockets without changing the luminaires' housing or wiring.

5. Electrical boxes that are finished with a blank cover, or electrical boxes where no electrical equipment has been installed, where the electrical box can be used for a luminaire or a surface mounted ceiling fan.
6. LED lighting which has not been certified to the Energy Commission as high efficacy.

6.2.3 Qualifying a Lighting System as High Efficacy

“Lumens per watt” for lighting is analogous to “miles per gallon” for an automobile. The lumen is the unit of visible light. To be rated as high efficacy, a lamp must produce a certain number of lumens for each watt of electrical power it consumes. Efficacy is therefore measured in lumens per watt. The following lighting systems typically qualify as high efficacy light sources:

1. Fluorescent lamps equipped with electronic ballasts
2. LED lighting which has been certified to the Energy Commission as high efficacy
3. Metal halide lighting (a type of HID lamp)
4. High Pressure Sodium (a type of HID lamp)
5. Low Pressure Sodium (however, this technology is not recommended for use in residential applications. It is not often used anymore in any application because it has the worst color rendering of any light source, having a deep yellow color)
6. Induction Lighting

The following lighting systems do not qualify as high efficacy lighting systems:

1. Incandescent lamps of any type (including any screw-in incandescent lamps, like regular ‘A’ or reflector lamps, or quartz halogen lamps, or low voltage lamps, like halogen MR lamps).
2. Mercury vapor lamps (a type of HID lamp)

To be classified as high efficacy, a lamp or lighting system must meet the requirements listed in Table 150-C of the Standards. For clarity, Table 150-C of the Standards is shown below as two different tables. It is shown as Table 6-1 for all lighting systems which are not LED lighting, and it is shown again as Table 6-2 for all LED lighting.

Lighting Other Than LED

§150(k)1; Table 150-C

For any lighting systems which are not LED lighting, simply divide the initial rated lumens of the lamp by the rated watts of the lamp. Lamp lumens can typically be found on the lamp package or in a manufacturer's catalogue. This calculation method should be used for any lighting system which is not LED lighting, including the following types of lighting systems:

1. Line-voltage incandescent
2. Low-voltage incandescent
3. Fluorescent
4. High intensity discharge (HID)
5. Induction

For simplicity, for non-LED lighting, the power used by the ballast or transformer is ignored when determining the lumens per watt for purposes of classifying lighting systems as high efficacy for compliance with the Residential Lighting Standards.

However, when determining how many watts of high and low efficacy lighting is being installed in residential kitchens, the power used by the ballast or transformer is included. Additional information about determining installed lighting power in residential kitchens is in Section 6.2.4.

A high efficacy luminaire, for all lighting systems which are not LED lighting, shall meet the minimum lamp efficacy requirements in Table 6-1 (which is Table 150-C in the Standards).

Table 6-1 – High Efficacy Lamps – Other Than LED Lighting

Lamp Power	Minimum Lamp Efficacy
5 W or less	30 lm/W
over 5 W to 15 W	40 lm/W
over 15 W to 40 W	50 lm/W
over 40 W	60 lm/W

LED Lighting

§119(m); Table 150(c)

An LED Luminaire, or LED Light Engine with Integral Heat Sink, shall be certified to the Energy Commission before it can be classified as high efficacy for compliance with the Residential Lighting Standards. Any LED lighting system which has not been certified to the Energy Commission as high efficacy shall be classified as a low-efficacy lighting system. Additional information about certifying to the Energy Commission is in Section 6.2.9.

LED wattage, luminous flux, and efficacy must be determined according to Reference Joint Appendix JA8 (JA8), or to IES LM-79-08. See Section 6.2.10 for additional information about testing LED lighting.

§130(d)5 clarifies that the input power for LED lighting shall be the maximum rated input wattage of the system, including power used by fans, transformers and power supply devices. The maximum rated input wattage shall be listed on a permanent, pre-printed, factory-installed label.

A high efficacy LED luminaire or high efficacy LED source system shall meet the minimum system efficacy requirements in Table 6-2 (which is Table 150-C in the Standards).

For a Hybrid LED Luminaire to qualify as high efficacy, the LED Light Engine with Integral Heat Sink shall meet the minimum system efficacy requirements in Table 6-2, shall be certified to the Energy Commission as high efficacy, and all other lighting systems in the luminaire shall meet the minimum lamp requirements in Table 6-1 (which is Table 150-C in the Standards).

The Standards require that the maximum rated input wattage shall be listed on a permanent, pre-printed, factory-installed label as specified by Underwriters Laboratories (UL). However, there's a new LED lighting system recently introduced, where a centrally located driver is being used to operate more than one luminaire. Therefore, when multiple luminaires are connected to a single power supply/driver, the label used to determine the maximum wattage of the LED system shall be located on the LED power supply/driver, and the wattage of the system shall be based on the connected load of that LED power supply/driver as determined by the luminaire manufacturer or the rating of that LED power supply/driver as determined by the manufacturer of the power supply/driver.

Table 6-2– High Efficacy LED Lighting Source Systems

System Power Rating for LED Lighting	Minimum System Efficacy for LED Lighting
5 W or less	30 lm/W
over 5 W to 15 W	40 lm/W
over 15 W to 40 W	50 lm/W
over 40 W	60 lm/W