Issue 117 | November – December 2016

# BLUEPRINT

California Energy Commission
Efficiency Division

## The Lighting Issue



## Title 24's JA8 and Title 20's State Regulated Lamp Requirements

### *JA8 Requirements for High Efficacy Lighting*

The ***2016 Reference Joint Appendix JA8*** (JA8) specifies minimum performance and quality requirements for high efficacy light sources. Effective January 1, 2017, certain high efficacy light sources must be JA8 certified before they can be installed in residential buildings for compliance with the *2016 Building Energy Efficiency Standards* (Energy Standards). Light sources that must be JA8 certified are listed in the right-hand column of **Table 1**.

Other light sources, such as pin based compact fluorescent lamps (CFL), linear fluorescents, high intensity discharge lamps (HID), and outdoor solid state lighting (SSL) luminaires do not necessarily need to be JA8 certified. These light sources are listed in the left-hand column of **Table 1**.

JA8 certified light sources must undergo thorough testing at an accredited testing laboratory[1] to ensure that the light sources meet all JA8 performance requirements. Some of the metrics tested include:

» Color rendering index (CRI)

» Correlated color temperature (CCT)

» Dimming

» Elevated temperature

» Flicker

» Lifetime

» Light source efficacy

JA8 certification ensures that installed light sources provide high quality, energy efficient, and long lasting illumination. This certification also helps to avoid issues such as delayed start, audible noise, flickering, overheating, or other problems associated with lighting technologies. JA8 certified light sources are required to have a JA8-2016 or JA8-2016-E[2] marking to indicate that the light source is certified to the California Energy Commission (Energy Commission). Additionally, JA8 light sources must be listed in the Energy Commission's **Modernized Appliance Efficiency Database System (MAEDBS)**.

[1] The light source under test shall be tested at a testing laboratory participating in the ISO/IEC 17025, by the National Voluntary Laboratory Accreditation Program (NVLAP) or other laboratory accreditation body operating in accordance with ISO/IEC 17011 and produced under an ongoing inspection program carried out by a Type A inspection body in accordance with ISO/IEC 17020.

### *2016 JA8 High Efficacy Light Sources Certification Process*

Certification of high efficacy light sources is completed by the manufacturer or a designated third party certifier. The manufacturer or third party certifier submits light source products for testing at an accredited testing laboratory. The laboratory must conduct light source testing in accordance to the methods described in JA8. If the light source meets all JA8 requirements, product and testing data must be recorded on the **data certification forms** and submitted to the Energy Commission for certification. After the product is certified, the light source product information will be added to MAEDBS.

### *Appliance Efficiency Regulations for State Regulated Lamps*

Effective January 1, 2018, general service LED lamps and small diameter directional lamps will be regulated by the Title 20 Appliance Efficiency Regulations (Appliance Standards). State regulated LED lamps[3] with screw base or GU-24 base, including LED retrofit kits designed for recessed can housings, must meet the requirements of the Appliance Standards to be sold or offered for sale in California.

[2] JA8-2016-E indicates that the light source meets all JA8 requirements and has additionally passed the elevated temperature test for use in ceiling recessed downlights and enclosed luminaires.

[3] "State-regulated Light Emitting Diode (LED) lamp" means a lamp capable of producing light with Duv between -0.012 and 0.012, and that has an E12, E17, E26, or GU-24 base, including LED lamps that are designed for retrofit within existing recessed can housings that contain one of the preceding bases. State-regulated LED lamp does not include a lamp with a brightness of more than 2,600 lumens or a lamp that cannot produce light with a correlated color temperature between 2200 K and 7000 K.

| Table 1 - High Efficacy Light Sources | |
|---|---|
| No JA8 Certification Required | JA8 Certification Required |
| » Pin-based linear or compact fluorescent light sources using electronic ballasts<br>» Pulse-start metal halide<br>» High pressure sodium<br>» GU-24 sockets containing light sources other than LEDs[a,b]<br>» Luminaires with hardwired high frequency generator and induction lamp<br>» Inseparable SSL luminaires that are installed outdoors<br>» Inseparable SSL luminaires containing colored light sources that are installed to provide decorative lighting | » All light sources in ceiling recessed downlight luminaires[c]<br>» All light sources installed in enclosed luminaires<br>» GU-24 sockets containing LED lamps<br>» All screw base luminaires<br>» Inseparable SSL luminaires installed indoors<br>» Any light source not listed in this table |

a. GU-24 sockets containing light sources such as compact fluorescent lamps and induction lamps.

b. California Title 20 **Section 1605.3(k)4** does not allow incandescent sources to have a GU-24 base.

c. Ceiling recessed downlight luminaires cannot have screw base sockets, regardless of the lamp type, as described in **Section 150.0(k)1C**.

State regulated LED lamp regulations set minimum performance requirements which include:

» Chromaticity

» Color consistency

» CRI

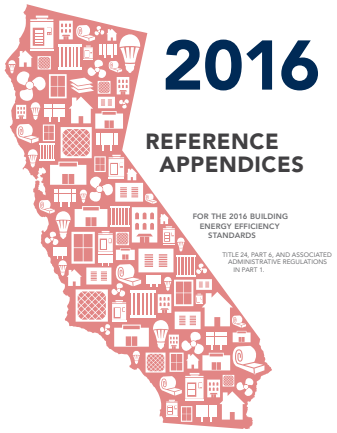
» Lifetime

» Light source efficacy

State regulated small diameter directional lamps[4] are non-tubular directional lamps with a diameter less than or equal to 2.25 inches with an ANSI ANSLG C81.61-2009 compliant pin base or E26 base.

"State-regulated small diameter directional lamp" means a directional lamp that meets all of the following criteria: 1. Capable of operating at 12 volts, 24 volts, or 120 volts; 2. Has an ANSI ANSLG C81.61-2009 (R2014) compliant pin base or E26 base; 3. Is a non-tubular directional lamp with a diameter of less than or equal to 2.25 inches; 4. Has a lumen output of less than or equal to 850 lumens, or has a wattage of 75 watts or less; and 5. Has a rated life greater than 300 hours.

State-regulated small diameter directional lamp includes incandescent filament, LED, and any other lighting technology that falls within this definition. State-regulated small diameter directional lamp does not include directional lamps with an E26 base that utilize LED and are covered under the definition of state-regulated LED lamps.





Small diameter directional lamp regulations set minimum performance requirements which include:

» Lifetime

» Light source efficacy

State regulated LED and small diameter direction lamps must undergo testing at an Energy Commission approved testing laboratory and be certified and listed in MAEDBS in order to be sold or offered for sale in California.

***Reference Joint Appendix JA8 High Efficacy Light Sources versus State Regulated Lamp Requirements***

The JA8 high efficacy light source requirements differ from the new state regulated lamp requirements. JA8 regulates light sources, including LED and small diameter directional lamps, installed in residential buildings. The Appliance Standards regulate lamps sold or offered for sale in California. LED and small diameter directional lamps may be subject to both the JA8 requirements and the Appliance Standards.

For example, in residential lighting projects, LED lamps must be JA8 certified to be installed for compliance with the high-efficacy light source requirements in the 2016 Energy Standards. This does not mean that all LED lamps must be JA8 certified. A homeowner can purchase and install any LED lamp, including LED lamps which are not JA8 certified, into their existing lighting fixture. However, if installing lighting fixtures with LED lamps in newly constructed buildings or alterations, the installed LED lamps must be JA8 certified. Compliance with this requirement is verified by the enforcement agency at final inspection of the building.

State regulated LED and small diameter directional lamps manufactured on or after January 1, 2018, must meet all performance and quality requirements of the Appliance Standards. This means that all state regulated LED and small diameter directional lamps must be certified to the Energy Commission and listed in MAEDBS. LED and small diameter directional lamps which are JA8 certified must meet the Appliance Standards for state regulated lamps if manufactured on or after this date. State regulated lamps manufactured on or after January 1, 2018, and that do not appear in MAEDBS cannot be legally sold in California. The Energy Commission's **Office of Compliance Assistance and Enforcement** works with manufacturers, distributors, and retailers to ensure these requirements are met.

JA8 and the Appliance Standards specify testing of similar performance and quality metrics for LED and small diameter directional lamps. However, there are differences between the requirements.

For example, JA8 specifies a minimum CRI of 90, while the Appliance Standards specify a minimum CRI of 82 for LED lamps. Both require the CRI to be tested. LED lamps which meet the Appliance Standards do not necessarily meet the JA8 high efficacy light source requirements.

Performance requirements for small diameter directional lamps also differ between JA8 and the Appliance Standards. For example, JA8 specifies a minimum luminous efficacy of 45 lumens per watt for small diameter directional lamps. The Appliance Standards specify a minimum luminous efficacy of 80 lumens per watt or have a minimum luminous efficacy of 70 lumens per watt or greater and a minimum compliance score of 165 or greater, where compliance is calculated as the sum of the luminous efficacy and CRI. Small diameter directional lamps which meet the JA8 high efficacy light source requirements do not necessarily meet the Appliance Standards.

**Table 2** shows some of the key differences between JA8 and the state regulated LED lamp requirements.

## 2016 Prescriptive Indoor Lighting Alteration Options

**Sections 141.0(b)2I** and **141.0(b)2J** of the 2016 Energy Standards provide three prescriptive compliance options for nonresidential entire luminaire replacements and luminaire component modifications.

***Option 1***

Install lighting up to the **allowance** for new nonresidential buildings and install the applicable controls for new nonresidential buildings. These controls include:

- Manual area
- Multi-level
- Shut-off
- Automatic daylight
- Demand responsive

**Table 2 - Key Differences**

| Parameter | Title 24 - JA8 (2016) | Title 20 (2016) | |
|---|---|---|---|
| Lamp Type | All Residential (Except Night Lights) | General Service LED Lamps (Tier 1) | Small Diameter Directional Lamps |
| Effective Date | January 1, 2017 | January 1, 2018 | January 1, 2018 |
| Base Type | All (Except Night Lights) | E12, E17, E26 and GU-24 | ANSI ANSLG C81.61-2009 or E26 |
| Power Factor | ≥ 0.9 | ≥ 0.7 | No requirement |
| Start Time | ≤ 0.5 sec | No requirement | No requirement |
| Lifetime | ≥ 15,000 hours | ≥ 10,000 hours | ≥ 25,000 hours |
| Dimming | Down to 10 percent | No requirement | No requirement |
| Efficacy | ≥ 45 lm/W | ≥ 68 lm/W and *((2.3 x CRI) + lm/W ) ≥ 282* | ≥ 80 lm/W or ≥ 70 lm/W and *(lm/W + CRI )≥ 165* |
| CCT | Inseparable ≤ 4000 K<br>Separable ≤ 3000 K | No requirement | No requirement |
| Chromaticity | -0.0033 ≤ Duv ≤ 0.0033 | ANSI C78.377-2015 compliant | No requirement |
| CRI | ≥ 90 | ≥ 82 | No requirement |
| R1-R8 | No requirement | ≥ 72 | No requirement |
| R9 | ≥ 50 | No requirement | No requirement |

***Option 2***

Install lighting up to 85 percent of the allowance for new nonresidential buildings and install a reduced set of controls. These controls include:

» Manual area

» Two-level

» Shut-off

Daylight, demand responsive, and full multi-level controls are not required.

***Option 3***

Install lighting that has a 50 or 35 percent lower rated power than the previously installed lighting and install a reduced set of controls. These controls include:

» Manual area

» Shut-off

Office, hotel, and retail spaces must achieve a 50 percent reduction in rated power. All other spaces must achieve a 35 percent reduction.

Please see **Table 3** for a side-by-side comparison of the three options.

It is important to note that the only difference in control requirements between Options 2 and 3 is that the former requires two-level controls. These controls are already present in many buildings.

**Options for different spaces:**

***Spaces where walls or ceilings will be added, removed, or replaced***

For these projects, Option 1 or 2 must be used. Per **Section 141.0(b)2Iii,** Option 3 is not allowed for projects where walls or ceilings will be added, removed, or replaced.

***Spaces where the lighting is already using an efficient technology***

Options 1 and 2 are most appropriate. To reduce the rated power of an efficient lighting system by 50 or 35 percent may be very difficult or impossible. This makes Option 3 an unlikely choice.

***Spaces where the lighting has not been updated for a significant amount of time***

Option 3 works well for these types of projects. It may be easy to meet or exceed the 50 or 35 percent rated power reduction by replacing old and inefficient systems with new lighting technology.

***Spaces where wiring can be easily accessed, where wiring will be replaced, or where wireless controls are being installed***

Option 2 could be used by installing the required controls. These controls can be inexpensive. If a higher power allowance is needed, Option 1 can be used by installing the appropriate controls. Option 3 could be used if the new lighting system has a 50 or 35 percent lower rated power than the previously installed lighting.

***Spaces where two-level or multi-level controls are already installed***

In these spaces, Option 2 provides a lighting power allowance as it is not dependent on the power use of the existing lighting. If the space already has full multi-level and daylighting controls, Option 1 provides an even higher power allowance. Again, Option 3 could be used if the new lighting system has a 50 or 35 percent lower rated power than the previously installed lighting.

More information about the nonresidential lighting alteration requirements can be found in **Sections 141.0(b)2I-L** of the 2016 Energy Standards and **Sections 5.9.4** and **5.9.5** of the *2016 Nonresidential Compliance Manual*.

**Table 3 - Control Requirements for Lighting Alterations**

| Applicable Section 130.1 Control requirements: | Resulting lighting power, compared to the lighting power allowance specified in **Section 140.6(c)2**, Area Category Method | | Option 3<br>Lighting power is reduced by 35/50% compared to existing |
|---|---|---|---|
| | Option 1<br>Lighting power is<br>> 85% to 100%<br>of allowance | Option 2<br>Lighting power is<br>≤ 85% of allowance | |
| **Sections 130.1(a)1, 2, and 3** Area Controls | Yes | Yes | Yes |
| **Section 130.1(b)**<br>Multi-Level Lighting Controls – only for alterations to general lighting of enclosed spaces 100 square feet or larger with a connected lighting load that exceeds 0.5 watts per $ft^2$ | Yes | For each enclosed space, minimum one step between 30-70 percent of lighting power regardless of luminaire type, or meet **Section 130.1(b**) | Not Required |
| **Section 130.1(c)**<br>Shut-Off Controls | Yes | Yes | Yes[1] |
| **Section 130.1(d)**<br>Automatic Daylight Controls | Yes | Not Required | Not Required |
| **Section 130.1(e)**<br>Demand Responsive Controls – only for alterations > 10,000 $ft^2$ in a single building, where the alteration also changes the area of the space, or changes the occupancy type of the space, or increases the lighting power | Yes | Not Required | Not Required |

[1] As bi-level controls are not required for this option, partial-off controls are not required to be installed in place of "full off" automatic shutoff controls for library book stack aisles, corridors and stairwells (see **Sections 141.0(b)2Iii** and **Jii**).

# Q&A

**What are the effective dates for compliance with the JA8 high efficacy light source requirements and the Appliance Standards state regulated LED lamp requirements?**

- January 1, 2017, for JA8 high efficacy light sources installed in residential new construction.
- January 1, 2018, for certification of state regulated LED and small diameter directional lamps manufactured for sale in California.

**Do LED lamps need to be JA8 certified?**

Yes, if the LED lamp is installed in lighting projects that require compliance with the residential high efficacy light source requirements of the 2016 Energy Standards. For example, if screw base luminaires are installed in a newly constructed residential building or in an alteration or addition to a residential building, the installed LED lamps must be JA8 certified. LED lamps do not need to be JA8 certified when replacing or installing lamps in existing luminaires.

**Do LED lamps need to be certified to the Energy Commission per the Appliance Standards?**

Yes. All state regulated LED and small diameter directional lamps manufactured on or after January 1, 2018, must be certified per the Appliance Standards and listed in MAEDBS to be legally sold or offered for sale in California. Manufacturers can voluntarily certify state regulated LED lamps before January 1, 2018.

**Do JA8 certified high efficacy LED lamps need to also be certified per the Appliance Standards?**

On or after January 1, 2018, JA8 certified high efficacy LED lamps must also be certified per the Appliance Standards as state regulated LED lamps. Requirements for JA8 and for state regulated LED lamps differ. JA8 certification does not necessarily indicate compliance with the Appliance Standards for state regulated LED lamps or vice versa.

**How do I certify a light source to JA8?**

Certification to the Energy Commission is completed by the manufacturer of the light source or a designated third party certifier. The light source must be tested at an accredited testing laboratory in accordance with the testing specifications in JA8. The resulting test data must be recorded and submitted to the Energy Commission. Once the Energy Commission has confirmed that data submitted complies with JA8, the light source product information will be listed in MAEDBS.

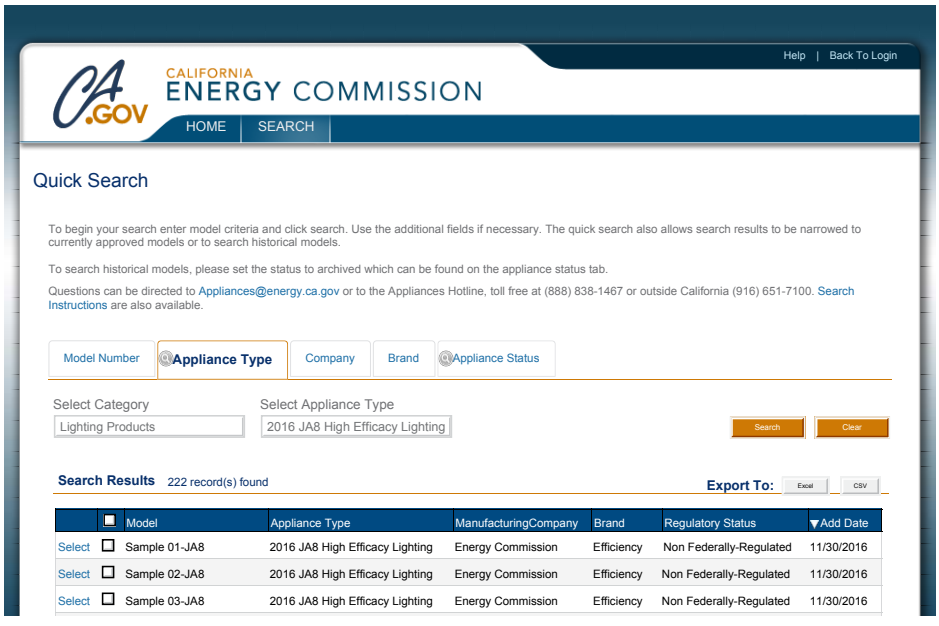
For more information on JA8 certification, please review the **Residential Lighting - JA8 Compliance for Test Laboratories** fact sheet.

**Do I, as a manufacturer, have to ship my luminaire with a JA8 certified high efficacy light source?**

No. The 2016 Energy Standards do not require luminaires to be prepackaged with a JA8 certified high efficacy light source.

NOTE: **Section 1605.3(n)(3)(A)4** of the Appliance Standards requires portable luminaires[4] with E12, E17, or E26 screw base sockets to be prepackaged and sold together with one screw based compact fluorescent lamp or screw based LED lamp for each screw based socket on the portable luminaire. This requirement applies to portable luminaires only. Screw based lamps used in portable luminaires do not need to be JA8 certified.

[4] "Portable luminaire" means a luminaire that has a flexible cord and an attachment plug for connection to a nominal 120-volt, 15- or 20-ampere branch circuit; that allows the user to relocate the luminaire without any rewiring; that are typically controlled with a switch located on the luminaire itself or on the power cord; and that are intended for use in accordance with the National Electrical Code, ANSI/NFPA 70-2002.



**If my product has a lamp shade, do I have to test my product with it on or off?**

It depends. If the shade can be removed by the end user, then the light source can be tested without the shade. If the end user does not have the option to remove the shade, the product must be tested with the shade.

**How do I know if an LED lamp is JA8 Certified?**

Certified light sources are required to have a mark to identify compliance with the JA8 high efficacy light source requirements. JA8 certified LED lamps must be marked with either JA8-2016 or JA8-2016-E. A listing of all JA8 certified LED lamps can be found in MAEDBS.

**What happens to light source products that are on the shelf after the effective date that may comply with the 2016 Energy Standards JA8 high efficacy light source requirements but aren't marked with JA8-2016 or JA8-2016-E?**

Light sources that must be JA8 certified and that do not have the JA8-2016 or JA8-2016-E marking may not be installed for compliance with the 2016 high efficacy light source requirements on or after January 1, 2017.

**Can I install a recessed downlight trim kit with a screw base adaptor?**

No. Recessed downlight trim kits in ceilings cannot contain screw base sockets per **Section 150.0(k)1Cv** of the 2016 Energy Standards. The trim kit should be hardwired or connected via quick connector. If the trim kit contains a screw base socket adaptor, the screw base can be removed and the trim kit can be installed as described above.

**Are the light sources required to be dimmable?**

JA8 high efficacy light sources must be dimmable to a minimum of 10 percent of the light source output per **Joint Reference Appendix JA8.4.6**:

> *"The light source shall be dimmable down to 10 percent light output where 100 percent full light output is defined as operating the light source at the maximum setting provided by the control."*

**Are high efficacy lighting requirements applicable to nonresidential buildings and spaces?**

No, high efficacy lighting requirements apply only to residential buildings and spaces.

## For More Information

**Home Energy Rating System:**
http://www.energy.ca.gov/HERS/

**Acceptance Test Technician Certification Provider Program:**
http://www.energy.ca.gov/title24/attcp/

**Approved Computer Compliance Programs:**
http://www.energy.ca.gov/title24/2016standards/2016_computer_prog_list.html

**The California Energy Commission welcomes your feedback on Blueprint. Please contact Andrea Bailey at:**
Title24@energy.ca.gov

## EDITOR

» Andrea Bailey

## SPECIAL THANKS

» Chris Olvera
» Christoper Meyer
» Daniel Wong
» Javier Perez
» Jose Perez
» Kristen Driskell
» Peter Strait
» Simon Lee



CEC-400-2016-027