Residential High-efficacy Lighting

Title 20 and Title 24, Part 6 JA8: Key Differences and Overlap

What Regulations and Standards Apply to High-efficacy Lighting?

Both California's Appliance Efficiency Regulations (Title 20) and the California Building Energy Efficiency Standards (Title 24, Part 6 or Energy Code) include requirements for lamps and luminaires (light fixtures), including the performance requirements outlined in Title 24, Part 6 Joint Reference Appendix JA8, Qualification Requirements for High Luminous Efficacy Light Sources.

This fact sheet is intended to clarify where these two standards overlap, where they are different and when each is applicable. It primarily focuses on general service lamps (GSLs), small-diameter directional lamps (SDDLs) and state-regulated LEDs (SLEDs) for residential spaces only.

Roles in the Compliance Chain

Understanding your role in the compliance chain may be difficult. Figure 1 illustrates the role of each market actor in the Title 20 and Title 24, Part 6 lamp compliance processes.

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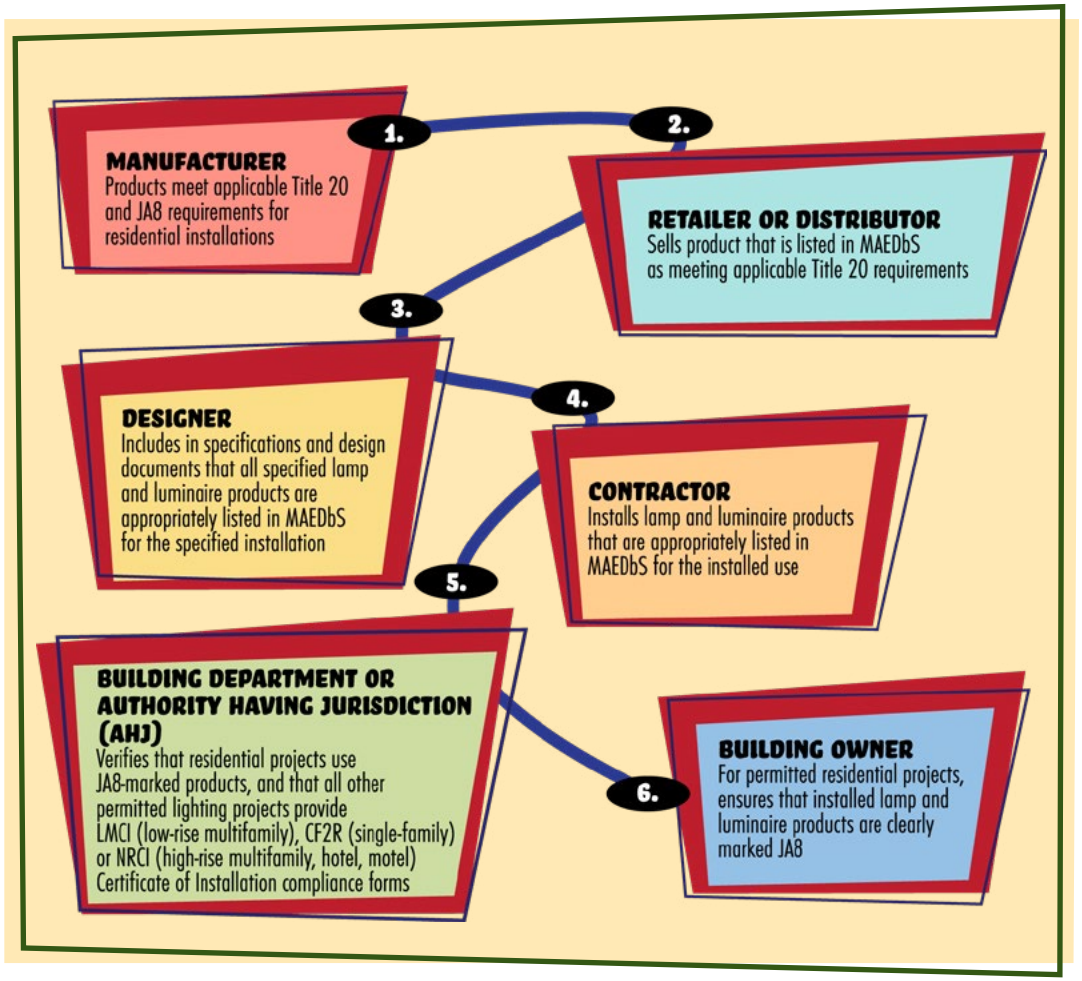

Figure 1. *Roles Applicable to this Fact Sheet*

Does this Fact Sheet Apply to My Project?

Title 20 requirements apply to covered lighting products when they are sold or offered for sale in California and used for any residential or nonresidential building type. On the other hand, Title 24, Part 6 applies to New Construction, Additions, permitted retrofits and building Alterations and requires all permanently installed luminaires in new single-family homes, townhouses, guest rooms in hotels and motels and dwelling units of new multifamily buildings to be high efficacy.

Residential Occupancies and Building Types with High-efficacy Lighting Requirements

Occupancy Group and Building Type California Building Code §§310 and 312		Building and Space Type Energy Code §100.1
Single-family Buildings		
R-3	**Residential Group R-3:** Buildings with 2 or fewer dwelling units for permanent residents	**Single-family:** Occupancy Group R-3 buildings with 2 or fewer dwelling units Examples: Houses, duplexes, townhomes, accessory dwelling units (ADUs) *Hotels, motels and multifamily buildings are excluded.*
Multifamily Buildings		
R-2	**Residential Group R-2:** Buildings with 3 or more dwelling units for permanent residents	**Multifamily:** A building, other than hotel or motel, of Occupancy Group R-2, R-3 or R-4 Examples: Dwelling units in apartment buildings *Hotels, motels and timeshares are excluded.*
R-3	**Residential Group R-3:** Some multifamily congregate residences with primarily permanent residents	**Multifamily:** A building, other than hotel or motel, of Occupancy Group R-2, R-3 or R-4 Examples: Dormitories *Boarding houses or alcohol or drug abuse recovery homes with over 6 guests are excluded.*
R-4	**Residential Group R-4:** Supervised residential environments for more than 6 ambulatory clients and up to 16 total residents, excluding staff	**Multifamily:** A building, other than hotel or motel, of Occupancy Group R-2, R-3 or R-4 Examples: Assisted living facilities, halfway houses, drug treatment facilities
Hotel and Motel Buildings		
R-1	**Residential Group R-1:** Buildings with sleeping units for primarily transient occupants	**Hotel and Motel:** Buildings with 6 or more guest rooms, vacation timeshare properties, boarding houses with over 6 guests, alcohol or drug abuse treatment facilities with over 6 guests Examples: Hotel and motel guest rooms
Single-family Residential Sites		
U	**Miscellaneous:** Accessory buildings and structures and miscellaneous structures not classified in any specific occupancy	**Occupancy Group U buildings on single-family residential sites** are considered single-family Examples: Barns, greenhouses, carports

Table 1. *Residential Occupancies and Building Types with High-efficacy Lighting Requirements*

Key Terms

Addition: New conditioned square footage and volume where new luminaires are installed for the first time

Alteration: A modification where luminaires are replaced, moved or added on a project with a building permit through an authority having jurisdiction (AHJ)

Color Rendering Index (CRI): The ability of a light source to reflect the color of illuminated objects with fidelity relative to ideal or natural light sources of the same color temperature. CRI is calculated according to CIE 13.3

Dwelling Unit: A single unit providing complete, independent living facilities for one or more persons including access, permanent provisions for living, sleeping, eating, cooking and sanitation

Delta uv (Duv): The closest distance from the chromaticity coordinate of the light source to the Planckian locus on the International Commission on Illumination (CIE) (u', 2/3 v') coordinates with "+" sign for above and "-" sign for below the Planckian locus

General Service Lamp (GSL): A lamp that has an ANSI base and an initial lumen output between 310 - 3,300 lumens. Types of GSLs include, but are not limited to, general service incandescent lamps, compact fluorescent lamps, general service light-emitting diode (LED) lamps, and general service organic LED lamps

Luminous Efficacy: A measure of the luminous efficiency of a light source. It is the quotient of the total luminous flux emitted divided by the total light source power input, expressed in lm/W.

Lamp: Lighting industry term for a light source, such as a light bulb or fluorescent tube

Light Source: The component in a luminaire that actually provides illumination, such as an LED lamp or a fluorescent tube (also called a *lamp* or *light bulb*)

Luminaire: A complete lighting unit consisting of a light source such as a lamp or lamps and parts designed to:"

- Distribute the light (lens, reflector)
- Position and protect the light source (housing)
- Connect the light source to the power supply (ballast, transformer; also commonly referred to as a *light fixture*)

Permanently Installed Luminaires: Hard-wired ceiling luminaires, chandeliers, vanity lamps, wall sconces, under-cabinet luminaires, luminaires in drawers or cabinets, night lights, step and path lights and any other luminaire that is attached to the building or buildings on the property

Portable Luminaires: Lighting that is not permanently installed or hard-wired but uses a plug-in connection for electric power (for example, a freestanding floor or table lamp)

Separable Light Source: A light source that can be replaced without cutting wires or soldering, such as pin-based or screw-in LED lamps

State-regulated LEDs (SLEDs): Lamps capable of producing light with Duv between -0.012 and 0.012, and that have an E12, E17, E26 or GU24 base, including LED lamps that are designed for retrofit within existing recessed can housings that contain one of the preceding bases. SLEDs do not include lamps with a brightness of more than 2,600 lumens or those that cannot produce light with a correlated color temperature of 2,200K to 7,000K

Small Diameter Directional Lamp (SDDL): A directional lamp that meets all of the following criteria:

- Capable of operating at 12 volts, 24 volts, or 120 volts
- Has an ANSI ANSLG C81.61-2009 (R2014) compliant pin base or E26 base
- Is a non-tubular directional lamp with a diameter of less than or equal to 2.25 inches
- Has a lumen output of less than or equal to 850 lumens, or has a wattage of 75 watts or less
- Has a rated life greater than 300 hours

Vacancy or Occupancy Sensor: An automatic-off lighting control that includes a manual-off option

Overview: Comparing Title 20 and Title 24, Part 6

One way to demonstrate that a lighting product is high-efficacy is to be certified and marked as Joint Reference Appendix JA8 compliant. Though there is significant overlap between some of the Title 20 lamp standards and the Joint Reference Appendix JA8 requirements, Joint Reference Appendix JA8 is only required for permanently installed luminaires in newly constructed buildings or as part of an Alteration project subject to the building code. Lamps with the Joint Reference Appendix JA8 marking on them can be purchased separately from the luminaire as long as the Joint Reference Appendix JA8-marked lamps are installed in the luminaires prior to inspection by the building department.

All luminaires (indoor and outdoor) must comply with Table 150.0-A and Table 160.5-A. Title 20 standards apply to specific types of lamps regardless of whether they will be used indoors or outdoors and regardless of building type. However, there are some exemptions and requirements that are specific to certain outdoor lamps, including LED light sources installed outdoors which are exempt from JA8 requirements.

Other Energy Code Ace™ fact sheets exist that provide an overview of both Title 20 lamp standards and Joint Reference Appendix JA8 residential lighting standards independently. See the For More Information page.

Key Differences

One of the key differences between the Title 20 lamp standards and the Joint Reference Appendix JA8 requirements is the way they are applied and enforced in the market. Table 2 outlines these differences.

Key Differences Between Title 20 and Title 24, Part 6 Joint Reference Appendix JA8 Requirements: Application and Enforcement

	Title 20	Title 24, Part 6 Joint Reference Appendix JA8
Effective Dates	Ranging from January 1, 2018 to January 1, 2020	2022 Energy Code: Construction projects applying for permit on or after January 1, 2023.
Applications	Applies to a specific set of lamp types when they are sold or offered for sale in California. Applies to all projects.	Applies to a specific set of building applications that are going through the Energy Code building inspection process: ✦ Single-family homes, accessory dwelling units (ADUs), townhouses, and dwelling units of multifamily buildings ✦ Dwelling units of nonresidential buildings including those in fire station, dormitory and senior housing buildings, as well as hotel and motel guest rooms Applies to permitted New Construction, Alterations and Additions only (e.g., not simply changing light bulbs in a home).
Requirements	Lamps within scope must be certified to the California Energy Commission (CEC) Modernized Appliance Efficiency Database System (MAEDbS) using the appropriate Title 20 appliance type in order to be legally sold or offered for sale in California.	Building applications listed above pulling a building permit must have high-efficacy light sources installed at the time of building inspection. Eligible high-efficacy light sources are those light sources listed in Tables 150.0-A and 160.5-A of 2022 Title 24, Part 6. Lamps must be certified to the CEC MAEDbS under the Title 24 section using the Joint Reference Appendix JA8 appliance category.
Who Is Responsible?	Retailers, manufacturers, contractors, importers and distributors must ensure the products they sell or offer for sale in California are certified to the MAEDbS.	Manufacturers must certify Joint Reference Appendix JA8-compliant lamps to the MAEDbS. Designers and builders must ensure that the products they specify in permitted projects are high-efficacy sources that can be installed. If designers specify Joint Reference Appendix JA8 products to meet this requirement, the builders must ensure they are specifying products marked as "Joint Reference Appendix JA8" in the MAEDbS.

Table 2: *Key Differences Between Title 20 and Title 24, Part 6 Joint Reference Appendix JA8 Requirements: Application and Enforcement*

Differences By Technical Requirements and Scope

The two standards also have differences in their technical requirements and scope. Table 3 outlines the key differences between Joint Reference Appendix JA8 requirements and the Title 20 lighting standards.

Key Differences Between Title 20 and Title 24, Part 6 Joint Reference Appendix JA8 Technical Requirements and Scope

	Title 20 §1601(k)			Title 24, Part 6 Joint Reference Appendix JA8
	State-regulated LED Lamps	**Small-diameter Directional Lamps**	**General Service Lamps**	**Permitted Residential, Non-legacy High-efficacy Lamps**
Effective Date	July 1, 2019 (Tier 1) January 1, 2020 (Tier 2)	January 1, 2018	January 1, 2020	2022 Energy Code: January 1, 2023
Definition	For the precise definition of each of these Title 20 lamp categories, please refer to Title 20, §1601. Approximate definitions are provided below..			See Tables 150.0-A and 160.5-A for specific light sources that must be certified Joint Reference Appendix JA8. Once certified, the light source can be used by builders to comply with the 2022 Title 24, Part 6 high-efficacy Joint Reference Appendix JA8 requirements.
	LED lamps and retrofit kits capable of producing light with Duv between -0.012 and 0.012, with base types E12, E17, E26 or GU24, that produce white light 200-2,600 lumens (150-2,600 lumens for candelabra lamps), and produce light with a correlated color temperature between 2,200K and 7,000K	Non-tubular directional lamps (of any source technology) with diameter ≤ 2.25" and an ANSI pin base or E26 base, designed to operate at 12V, 24V or 120V and ≤ 850 lumens or ≤ 75W*	Incandescent, halogen, compact fluorescent light bulbs (CFLs), and LED general service lamps that have ANSI bases and rated lumen output between 310 lumens and 3,300 lumens, and that are able to operate at a voltage of 12 volts or 24 volts, at or between 100 to 130 volts, at or between 220 to 240 volts, or of 277 volts for integrated lamps	
Power Factor	≥ 0.7	No Requirement	No Requirement	≥ 0.9
Start Time	No Requirement	No Requirement	No Requirement	≤ 0.5 seconds
Lifetime	≥ 10,000 hours	≥ 25,000 hours	≥ 1,000 hours (for general service incandescent lamps [GSIL] only)	≥ 15,000 hours
Lumen Maintenance	No Requirement	No Requirement	No Requirement	No Requirement (previously required in 2016 and 2019 Energy Code)
Dimming	If dimming is claimed, the lamp must dim to 10%. A lamp must be dimmable in order to include marketing that makes comparisons to incandescent lamps.	No Requirement	No Requirement	All lamps must dim to 10%. A lamp must be compatible with forward phase cut control, reverse phase cut, powerline carrier or 0-10 VDC dimming controls.

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	Title 20 §1601(k)			Title 24, Part 6 Joint Reference Appendix JA8
	State-regulated LED Lamps	**Small-diameter Directional Lamps**	**General Service Lamps**	**Permitted Residential, Non-legacy High-efficacy Lamps**
Flicker	If dimming is claimed, it also must meet the low flicker operation requirements (and noise requirements).	No Requirement	No Requirement	All lamps must meet the low flicker operation requirements of Joint Reference Appendix JA10.
Efficacy**	≥ 68 lumens/watt (Tier 1) ≥ 80 lumens/watt (Tier 2)	≥ 80 lumens/watt	≥ 45 lumens/watt	≥ 45 lumens/watt
Color Rendering Index (CRI)	≥ 82	No Requirement	≥ 80 (GSILs)	≥ 90 for all products other than T20 lamps ≥ 82 for T20 lamps
Correlated Color Temperature	No Requirement	No Requirement	No Requirement	≤ 4,000 Kelvin all sources
Chromaticity	ANSI C78.377-2015 Compliant	No Requirement	No Requirement	No Requirement
R1-R8	≥ 72	No Requirement	No Requirement	No Requirement
R9	No Requirement	No Requirement	No Requirement	≥ 50 for all products other than T20 lamps
Survival Rate	No Requirement	No Requirement	No Requirement	90% survival for a ten-lamp (or larger) sample group 100% survival otherwise
Ambient or Elevated Temperature	No Requirement	No Requirement	No Requirement	Light sources tested using the ENERGY STAR Product Specification for Lamps Version 2.1 may perform either the Ambient Temperature Life Test Method or the Elevated Temperature Life Test Method.
Light Distribution Requirement	Omnidirectional lamps (A-lamps): ENERGY STAR Lamps Version 2.0 requirements Decorative lamps (B, BA, C, CA, F or G): ENERGY STAR Lamps Version 1.1 requirements	No Requirement	No Requirement	No Requirement
Audible Noise	No Requirement	No Requirement	No Requirement	100% light output: Audible Noise ≤ 24 dBA. 20% light output: Audible Noise: ≤ 24 dBA
Frequency or Amplitude	No Requirement	No Requirement	No Requirement	For all systems where reporting of flicker is required, the test data shall be submitted to the California Energy Commission in the format specified in Table JA-10.

(Continued)

	Title 20 §1601(k)			Title 24, Part 6 Joint Reference Appendix JA8
	State-regulated LED Lamps	Small-diameter Directional Lamps	General Service Lamps	Permitted Residential, Non-legacy High-efficacy Lamps
MAEDbS Listing Requirements	Any entity conducting testing on appliances to be listed in the MAEDbS must meet the requirements of Title 20, §1603(a) and be approved by the CEC. Also, such testing may be conducted by an "Approved Industry Certification Program" who fulfills the requirements of Title 20, §1603(b). Requirements for listing appliances in the MAEDbS are located in §1606. Any third-party certifier intending to list appliances in the MAEDbS must also meet the requirements of §1606(f). Entities approved to submit data to the MAEDbS may submit manually or in Excel spreadsheet batches.			Test lab must be participating in the ISO/IEC 17025 NVLAP or other laboratory accreditation body operating in accordance with ISO/IEC 17011. (See Joint Reference Appendix JA8.2.)
Product Labeling Requirements	Complete marking requirements are found in Title 20, §1607. Lamp products must include manufacturer's name, brand name, or trademark, model number and date of manufacture, including year and month or smaller increment. This information must be permanently, legibly and conspicuously displayed on an accessible place on each unit, on the unit's packaging or, where the unit is contained in a group of several units in a single package, on the packaging of the group, in compliance with Title 20, §§1607(b) and 1607(c)(2). Title 20, §1607(d)(12) includes additional requirements for SLEDs making claims of dimmability or comparisons to incandescent lamps.			Light sources that meet Elevated Temperature Life Test must be marked with "JA8-2016-E," "JA8-2019-E" or "JA8-2022-E," which means they are for use in enclosed fixtures. Other light sources that meet Joint Reference Appendix JA8 requirements are marked with "Joint Reference Appendix JA8-2016 or 2019 or 2022."

***CRI** = color rendering index; **Duv** = delta uv; **GSIL** = general service incandescent lamp; **GSL** = general service lamp; **LED** = light emitting diode; **SSL**= solid-state lighting; **SDDL** = small-diameter directional lamp; **SLED** =* state-regulated LED; ***VDC** = voltage DC (direct current).*

** **State-regulated small diameter directional lamps** do not include directional lamps with an E26 base that use LEDs and are covered under the definition of state-regulated light emitting diode lamps.*

*** **SLEDs and SDDLs** have minimum requirements for both efficacy and CRI. SLED requirements for efficacy: 68 lumens/watt with a minimum compliance score of 282. (The compliance score is the sum of the efficacy and 2.3 times the CRI of a lamp.) SDDL requirements for efficacy: either 80 lumens/watt or 70 lumens/watt with a minimum compliance score of 165. (Compliance score is the sum of efficacy and CRI.)*

***Table 3:** Key Differences Between Title 20 and Title 24, Part 6 Joint Reference Appendix JA8 Technical Requirements and Scope*

Compliance Examples

Table 4 provides some examples of which light sources and applications must comply with Title 20 and Joint Reference Appendix JA8 requirements.

Compliance Examples		
Light Source Type and Application	**Must Meet Title 20?**	**Must Meet Joint Reference Appendix JA8?**
LED light engine or integral solid state luminaire installed in residential New Construction	No	**Yes**
Screw-based A-lamp being installed in residential New Construction or permitted Alteration	Yes	Yes
Screw-based A-lamp being sold through retail (not installed in a residential New Construction project or permitted Alteration)	**Yes**	No
MR16 lamp being sold through retail (not installed in a residential New Construction project or permitted Alteration)	**Yes**	No
Recessed downlight luminaires installed in ceiling for a residential permitted project Note: ✦ These luminaires must be labeled Joint Reference Appendix JA8-2016 or 2019 or 2022 for elevated temperature. ✦ Recessed fixtures are not allowed to have screw-based sockets in residential New Construction and permitted Alterations. ✦ Alterations can retain existing screw-based can lights as long as existing can lights meet the requirements of §150.2(b)1K or §180.2(b)4A.	No	**Yes**

Table 4: *Compliance Examples*

For More Information

CALIFORNIA ENERGY COMMISSION

www.energy.ca.gov

Learn more about the California Energy Commission (CEC) and its programs on its website.

2022 Building Energy Efficiency Standards

Explore the main CEC web portal for the 2022 Energy Code, including information, documents and historical information.

2022 Building Energy Efficiency Standards Summary

View or download this visual summary of the Energy Code's purpose, current changes and impact.

Energy Code Hotline

Call: 1-800-772-3300 (Free)

Email: Title24@energy.ca.gov

Online Resource Center

Use these online resources developed for building and enforcement communities to learn more about the Energy Code.

California Appliance Efficiency Regulations, Title 20

- §1602(k) – Definitions: Lamps
- §1604(k) – Test Methods for Lamps
- §1605.3(k)(2) – Standards for State-Regulated LED Lamps and General Service Lamps
- §1607– Marking of Appliances

2022 California Building Energy Code, Title 24, Part 6

- §160.5 – Mandatory Lighting Requirements for Indoor and Outdoor Spaces (Dwelling Unit)
- §110.0 – Systems and Equipment - General
- §110.1 – Mandatory Requirements for Appliances
- §110.9(b) – Mandatory Requirements for Lighting Control Devices and Systems, Ballasts, and Luminaries

Joint Reference Appendix JA8 High Efficacy Light Sources

- §§130.0(b) and 160.5(b) – Lighting Systems and Equipment and Electrical Power Distribution Systems
- §150.0(k) – Mandatory Features and Devices: Single-family Lighting
- §160.5(a) – Mandatory Features and Devices: Multifamily Lighting
- Joint Reference Appendix JA8 (JA8) – Qualification Requirements for High Efficacy Light Sources
- Joint Reference Appendix JA10 (JA10) – Test Method for Measuring Flicker of Lighting Systems and Reporting Requirements

California Appliance Efficiency Standards Site:

Appliances Call Center: (888) 838-1467

Outside California: (916) 651-7100

Email: Appliances@energy.ca.gov

- Fact Sheet: MAEDbS 101
- CEC Certification Packets for Appliances
- Modernized Appliance Efficiency Database (MAEDbS)

EnergyCodeAce™

www.energycodeace.com

Stop by this online "one-stop-shop" for no-cost tools, training and resources designed to help you comply with California's Title 24, Part 6 and Title 20.

Tools

www.energycodeace.com/tools

Explore this suite of interactive tools to understand the compliance process, required forms, installation techniques and energy efficiency regulations in California.

Reference Ace

Navigate the Title 24, Part 6 Energy Code using an index, keyword search and hyperlinked text.

Q&Ace

Search our online knowledge base or submit your question to Energy Code Ace experts.

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For More Information (continued)

Training

www.energycodeace.com/training

On-demand, live in-person and online training alternatives are tailored to a variety of industry professionals and address key measures.

Of Special Interest:

- *2022 Title 24, Part 6 Essentials — Residential Standards: Lighting*

Resources

www.energycodeace.com/resources

Downloadable materials provide practical and concise guidance on how and when to comply with California's building and appliance energy efficiency standards.

Of Special Interest:

Fact Sheets

- *Multifamily Buildings: What's Changed in 2022*
- *Nonresidential Buildings: What's Changed in 2022*
- *Single-family Buildings: What's Changed in 2022*
- *Multifamily Buildings: What's New in 2022*
- *Nonresidential Buildings: What's New in 2022*
- *Single-family Buildings: What's New in 2022*
- *Residential Lighting*
- *Title 20 Certification Overview, Process and FAQs*
- *Title 20 Lighting FAQs*
- *Residential High-efficacy Lighting for Manufacturers*

Report: Sample MATLAB Fourier Low Pass Filter Routine

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SCAN ME

This program is funded by California utility customers and administered by Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E®), and Southern California Edison Company (SCE) under the auspices of the California Public Utilities Commission.