

Designers Light Forum  
**Understanding California Title 24  
and 20 and Its Impact on Lighting**

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

# Learning Objectives

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At the end of the this course, participants will be able to:

1. What are Title 24 and 20
2. How often do the codes change
3. What is driving the code changes in California
4. Biggest changes in Title 24 Residential and Non-residential, & Title 20

## What is driving all of these regulations ?

- The California Energy Commission is the state's primary energy policy and planning agency. The agency was established by the Warren-Alquist Act in 1974 in response to the energy crisis of the early 1970s and the state's unsustainable growing demand for energy resources.
- California is set to achieve its goal of having all newly constructed low-rise residential buildings be zero-net energy (ZNE) by 2020 and all new commercial buildings be ZNE by 2030.

## What are Title 24 and Title 20

- Title 24 are the building standards used to create and modify new and existing buildings in energy conscious ways.
- Title 20 is the appliance regulations. Lamps are considered appliances along with refrigerators, ranges, pool pumps and many more devices.

## How often do the codes change?

- Title 24 is modified on a 3 year cycle. The current 2016 regulations will be modified in the 2019 code cycle. (As a side note, the 2019 code is being finalized in the spring of 2018, adoption hearings are scheduled for early February)
- Title 20 is modified when the need arises. There is no specific cycle as with Title 24.

## T24 – 2016 – Residential Changes

- Luminaires – This is not the code, but the changes
- Lamps – Whole new ball game.
- Controls – Some new things here too.
- Outdoor – Some changes here as well but not as many.

# Luminaire Requirements

- All Residential Lighting will now be High Efficiency and must comply with Table 150.0
- These types automatically qualify as High Efficiency
  - Pin Based Linear Fluorescent lamps on electronic ballasts.
  - Compact Fluorescent Lamps using electronic ballasts.
  - Pulse Start Metal Halide.
  - High Pressure Sodium.
  - GU-24 socketed luminaires other than LED (CFL and Induction).
  - Note – T20 does not allow incandescent sources to have GU-24 bases.
  - Hardwired high frequency Induction systems.
  - Inseparable SSL luminaires installed outdoors.
  - Inseparable SSL Luminaires with colored sources for decorative lighting.



## Luminaires too...

- Qualify
  - Luminaires that contain JA-8 or JA-8-E lamps.
    - Ceiling recessed downlight luminaires shall NOT have screw base sockets regardless of lamp type.
    - GU-24 Sockets containing LED sources
  - Any light source not listed in Table 150.0-A that is:
    - Certified to the CEC per JA-8

## JA-8 and JA-8-E - Explained

- This is a reference appendices to the code.
- Joint Appendix 8
- Gives the qualification requirements for high efficacy light sources
- Applies only to residential lighting
- Manufacturers must certify to this standard and provide documentation to the CEC for the light source to be marked JA-8 or JA-8-E.
- The –E is for elevated temperature rated sources (usually enclosed)

# JA-8 and JA-8-E - Requirements

- Requirements
  - Certified Test Lab
  - Tests
    - Efficacy
    - Power Factor
    - Start Time
    - Color Characteristics
    - Ambient Temperature Life
    - Elevated Temperature Life
    - Minimum Dimming level
    - Flicker
    - Audible Noise

# JA-8 and JA-8-E - Qualifications

- Qualifications
  - Efficacy - > 45LPW
  - Power Factor - >.9
  - Start Time - <0.5 seconds
  - Color Characteristics – CRI >90 and R9 >50 \* LED <4000 CCT and Other sources <3000CCT
  - Lumen Maintenance >86.7 % after 6000 hours
  - Inseparable Luminaires – L70>25,000 hours
  - Rated life - >15,000 hours
  - Survival rate – 90% of tested must be operational at 6,000 hours.
    - Exception for Inseparable SSL – Reference in-situ Temperature of LED.
  - Dimming
    - Down to 10%
    - Exception – LED based sources designed to be dimmed other than forward phase cut dimmers.

## JA-8 and JA-8-E – Qualifications (Cont.)

- Reduced Flicker Operations
  - Light sources in combination with specified control shall provide ‘reduced flicker operation’ when tested at 100% and 20% Per JA-10
- Audible Noise
  - 0-24dBA measures 1 meter from source tested at 100% and 20%
- Marking
  - JA8-2016
  - JA8-2016- E – Elevated temperature such as enclosed fixtures
- Data Reporting
  - All data submitted to CEC – and listed on MADEBS under ‘2016 JA8 High Efficiency Lighting’

## Mandatory Measures – 150.0(k)

- All installed luminaires shall be high-efficacy
- Blank electrical boxes greater than 5 feet above floor must be less than or equal to the number of bedrooms. They must also be served by a dimmer, vacancy sensor or fan speed control.

## Mandatory Measures – 150.0(k) – (Cont.)

- Recessed Downlights must meet the following
  - 1. Be listed Zero clearance IC by UL or other nationally recognized testing/rating laboratory
  - 2. Labeled airtight
  - 3. Sealed with gasket caulk
  - 4. Allow ballast or driver maintenance/replacement from below ceiling without cutting holes in ceiling.
  - 5. Shall NOT contain screw base sockets
  - 6. Shall contain light sources per JA-8 – including marking.

## Mandatory Measures – 150.0(k) – (Cont.)

- Luminaire Requirements – (Cont.)
  - Electronic Ballasts >13 watt fluorescent
  - Night Lights - <5 watts
  - Lighting integral to exhaust fans shall comply.
    - Exception – Manufactured Kitchen exhaust hoods.
- Screw base luminaires shall meet all the following:
  - 1. Not recessed downlight in ceiling
  - 2. Contain lamp complying with JA-8
  - 3. Marked per JA-8 – ‘JA8-2016’ or ‘JA8-2016-E’
    - Exception – Luminaires with hard wired ballasts for HID



## Mandatory Measures – 150.0(k) – (Cont.)

- Enclosed Luminaires
  - Only light sources marked 'JA8-2016-E' shall be used in enclosed fixtures

## Switches

- Forward Phase Cut dimmers LED shall comply with NEMA SSL 7A
- Exhaust fans shall be switched separately from lighting systems
- Readily accessible manually switched on and off
- No controls shall bypass a dimmer or vacancy sensor
- Comply with T-24 110.9
- Energy Monitoring Control Systems (EMCS) may be used as dimmer if it provides the functionality and installation certificate per T-24 130.4
- EMCS may be use as vacancy control sensor if it provides the functionality and installation certificate per T-24 130.4

## Switches (Cont.)

- Multi-scene programmable controller can be used as a dimmer if it provides the functionality and installation certificate per T-24 130.4.
- Bathroom, Garage, Laundry and Utility rooms >1 luminaire in each space will be controlled by a vacancy sensor.
- Dimmers or Vacancy Sensors shall control all luminaires required to comply with JA-8.
  - Exception – Closet <70 sq. ft.
  - Exception – Luminaires in hallways
- Under cabinet lighting will be switched separately from other luminaires.

# Other indoor lighting

## Indoor Parking Garage

8 or more vehicles	Less than 8 vehicles
Comply with Non-residential indoor lighting standards	Comply with residential indoor lighting standards

## Indoor common area of low-rise multi-family residential building

<20% common area	>20% common area
High efficacy luminaires and occupancy sensors	Comply with nonresidential indoor lighting standards

# Outdoor Lighting

- All installed outdoor luminaires on buildings shall be high efficacy.
- Additionally
  - Single Family Residential shall have manual on/off that does NOT override:
    - Option 1 – Photo control and motion sensor
    - Option 2 – Photo control and one of the following
      - Automatic Time Switch Control
      - Astronomical Time Clock
      - EMCS
    - If temporary override shall automatically return <6 hours.
- Address Signs
  - Option 1 - <5 watts
  - Option 2 – Comply with non residential lighting standards

## Outdoor – Low Rise Multifamily

- Private Patios, Entrances, Balconies, Porches
- Residential parking lots and carports (<8 vehicles)
- Option 1 – Comply with Single family residences
- Option 2 – Comply with Nonresidential outdoor

# T24 Commercial

Changes for 2016



# The Big Changes

- Controls
  - Indoor
  - Outdoor
  - Daylighting
- Modifications
  - Additions
  - Alterations
- Reference Materials



## Controls- Indoor - § 130.1

- In previous iterations of Title 24 (usually referred to as The Code or T24) The use of controls was voluntary, now most are mandatory.
- Please note that what follows are the basics of the code, there are exceptions which are too lengthy to mention here. Please refer to the actual code.
- Shut off Controls – Occupancy sensors or vacancy sensors are required:
  - Office less than or equal to 250 sq. ft.
  - Multipurpose rooms less than 1000 sq. ft.
  - Classrooms and Conference rooms of any size.
  - Countdown timers are allowed only in closets, single-stall public bathrooms less than 70 sq. ft. and server rooms
- Automatic Daylight Controls
  - Daylit areas require separate automatic controls



## Controls – Indoor - § 130.1 - Continued

- Area Controls
  - All luminaires must be functionally controlled with readily accessible manual ON and OFF lighting controls
- Multi-Level Controls
  - Dimmable luminaires must be controlled by a dimmer that satisfies all control steps in Table 130.1A and has manual ON/OFF functionality.
- Indoor Sign Lighting
  - All must be controlled with an automatic time-switch control or an astronomical time switch control.

# Lighting Controls – Table 130.1a

Luminaire Type	Minimum Required Control Steps ( percent of full rated power <sup>1</sup> )				Uniform level of illuminance shall be achieved by:
Line-voltage sockets except GU-24	Continuous dimming 10-100 percent				
Low-voltage incandescent systems					
LED luminaires and LED source systems					
GU-24 rated for LED					
GU-24 sockets rated for fluorescent > 20 watts	Continuous dimming 20-100 percent				
Pin-based compact fluorescent > 20 watts <sup>2</sup>					
GU-24 sockets rated for fluorescent ≤ 20 watts	Minimum one step between 30-70 percent				Stepped dimming; or Continuous dimming; or Switching alternate lamps in a luminaire
Pin-based compact fluorescent ≤ 20 watts <sup>2</sup>					
Linear fluorescent and U-bent fluorescent ≤ 13 watts	Minimum one step in each range:				Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire illuminating the same area and in the same manner
Linear fluorescent and U-bent fluorescent > 13 watts					
Track Lighting	Minimum one step between 30 – 70 percent				Step dimming; or Continuous dimming; or Separately switching circuits in multi-circuit track with a minimum of two circuits.
HID > 20 watts	Minimum one step between 50 - 70 percent				Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner.
Induction > 25 watts					
Other light sources					

1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor

2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps

I know this table is hard to read, but it is one of your best control friends.



## Controls - Outdoor

- New outdoor lighting zone zero
- BUG (Backlight, Up-light, Glare rating) requirements have been added to Part 11.
- Outdoor sales lots and canopies are no longer exempt from shut-off and motion sensor if mounting is  $\leq 24$  ft. from the ground.
- Outdoor motion sensors must reduce power consumption by at least 40% and not more than 90%
- Outdoor lighting must be controlled separate from other loads.

## Control Credits

- Power Adjustment Factors – (PAF) are listed in table 140.6a.
- This table is your friend and allows you to get additional credits for exceeding the minimum standards set out.
- There were some new areas added to the PAF table that will allow you to make your lighting job the best it can be and allow you some additional flexibility in your overall design.
- Eligible controls –
  - Daylight Dimming plus OFF control.
  - Occupant Sensing Controls
  - Institutional Tuning
  - Demand Responsive Controls

## Controls – Title 20 Compliant

- Title 20 are the appliance standards for California and govern what can and cannot be sold in the state.
- The California Energy Commission (CEC) sets the recommendations for minimum requirements for an appliance to be considered “California quality”.
- Only regulated products that have been tested, certified, and listed in the appliance efficiency database may be legally sold or offered for sale in California.
- MAEDBS - Modern Appliance Efficiency Database System – This is for all appliances not just lamps.
- To see if a product is listed in the database, you may do a search at:  
<https://cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx>

## Lighting Alterations

- The other big area of change for the 2016 T24 Code cycle was to Modifications.
- Modifications and Alterations
- These are levels of change with will trigger the code to be applied.
- These fall into 3 main areas –
  - Entire Luminaire Alterations
  - Luminaire component modifications
  - Lighting Wiring Alterations

## Alterations – Entire Luminaire Alterations § 141.21

- Removing/Reinstalling 10% or more of existing luminaires.
- Replacing or adding entire luminaires
- Changing the area and moving fixtures – adding or moving walls.
- When replacement is happening without space modifications then the new luminaire must:
  - Reduce rated power by 50% for office, retail, hotel and by 35% for other areas
  - Meet all requirements in Table 141.0e – Requirements for entire luminaire alterations.



## Alterations – Luminaire Component Modifications § 141.2J

- Replacement of Ballast or Driver and the associated lamps.
- Permanently changing the light source
- Modifying less than 70 existing luminaires per floor in a year will not trigger the code.
- 70 or more then:
  - You must meet the Lighting Power Allowance from § 140.6, and comply with requirements in Table 141.0e
  - Reduce rated power by 50% for office, retail, hotel and by 35% for other areas.
- Additionally modifications should not prevent or disable existing lighting controls.

## Alterations – Exceptions

- If the alteration would cause the disturbance of Asbestos
- Alterations affecting 2 or fewer luminaires in an enclosed space
- Lighting controls acceptance testing is not required for alterations of a total of 20 or fewer luminaires.

# Title 20 – 2018 and 2019

## Things we will look at

- Who is impacted
- Types of lamps that are impacted
  - SLED – State Regulated LEDs
  - SDDL – Small Diameter Directional Lamps
  - General Service Lamps
- Important Dates
- Compliance

# State Regulated LED – SLED - Defined

- This includes lamps and retrofit kits that have ANSI bases :
  - E12 - Candelabra
  - E17 - Intermediate
  - E26 – Medium or often called standard.
  - GU-24



# SLED – Definitions and Requirements

- Have a Lumen output less than 2600 lumens.
- Minimum efficacy – Lumens per Watt (LPW) - 68
- Color target / color consistency – Must be white light source
- CRI – minimum 82
- Individual color scores (R1-R8 – The components of CRI) – minimum 72
- Power factor - 0.7 minimum
- Minimum Rated life - 10,000 hours
- Light Distribution – A Shape – Omnidirectional Energy Star V.2 – 220 degrees
- B, BA, C, CA, F, or G shapes: decorative light distribution requirements in ENERGY STAR Product Specification for Lamps Version 1.1 (August 2014)

## SLED – Requirements continued

SLEDs are not required to be dimmable but if they are dimmable they must meet the following requirements

- Dim down to 10% light output
- Have reduced flicker operation
- Not produce noise in excess of 24 A-weighted decibels at 100% and 20% outputs.
- If the product cannot dim using a standard phase-cut dimmer then the packaging must say – ‘dimmable with LED dimmer’ and must describe or link to a compatible dimmer list.

## SLED Requirements - Scoring

Compliance Score (Efficacy(LPW) + [2.3 x CRI])

- Tier 1 - January 1 2018 manufacturing must have a minimum score of 282.
- Tier 2 - January 1 2019 manufacturing must have a minimum score of 297 and a stand by wattage of less than .2 watts.
- i.e. a lamp with the minimum allowed LPW of 68 would have to have a CRI minimum of 93.01.
  - $282 \text{ minus } 68 \text{ divided by } 2.3 = 93.01$



## Small Diameter Directional Lamps – SDDL - Defined

- All technologies are covered – But primarily Incandescent, Halogen and LED.
- Operates at a primary voltage of 12, 24 or 120.
- Has an ANSI pin base or E26 base
- Must have a diameter  $\leq$  2.25 inches
  - MR16 impacted Par 20 not impacted.
- Has a output of  $<$  850 lumens or a wattage of  $<$ 75.
- Has a rated life of greater than 300 hours.

## SDDL Requirements

- Manufactured after January 1 2018.
- Must have an initial efficacy of 80 lumens per watt or 70 lumens per watt with a score of 165.
  - Score is different than SLED and it is efficacy(LPW) + CRI. So 70 LPW would have to have a CRI of 95 to pass.
- Minimum rated life of 25,000 hours.

# General Service Lamps - Defined

- Medium screw base lamps – E26
- Omnidirectional – General Service Incandescent, Compact Fluorescent, and LED lamps.
- Does not include Linear Fluorescent lamps, incandescent reflector lamps or HID.

# General Service Lamps Requirements

- If manufactured after January 1 2018.
  - Lumens between 310 and 2600
  - Efficacy (LPW) 45
  - Minimum rated life – 1000 hours
- Lamps exempted from these requirements – Appliance, Black light, Bug, Colored, Infrared, left-hand thread, marine lamp, marine signal service, mine service, plant, reflector, rough service, shatter resistant(including a shatter-proof and shatter-protected lamp), sign service lamp, silver bowl, showcase, 3-way incandescent, traffic signal and vibration service lamps

# Compliance Dates

- Implementation Dates
  - January 1, 2018 – Tier 1
  - January 1, 2019 – Tier 2
- Products manufactured after these implementation dates must comply with the standards.
- Manufacturers are allowed to continue selling products that are not in compliance as long as they are manufactured prior to December 31, 2017.

# Compliance

- To insure compliance the lamps, boxes, or master cartons must be marked with:
  - Manufacturer name, Brand name or Trademark
  - Model number
  - Date of Manufacture
- And as stated before they must be listed on the MAEDBS.

Questions?



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