



CALIFORNIA ENERGY COMMISSION

Changes for California 2008 Title 24 Lighting Standards



CALIFORNIA ENERGY COMMISSION

Title 20

Appliance Efficiency Regulations





Title 20 Scope

- New appliances sold or offered for sale in California
EXCEPT:
 - Sold wholesale in California for final retail sale outside the state
 - Designed and sold exclusively for use in recreational vehicles or other mobile equipment.
- Applies to units manufactured on or after the effective date of the provision
- Must be certified to the Energy Commission



T-20 General Service Incandescent Lamps

Common Wattages = 5% lower

Pre-T20 Wattage	January 2008 Wattage
100	95
75	71
60	57
40	38





T20 General Service Lamps

Equivalent lumen output compared to old rated wattage lamp	Maximum rated Wattage	Minimum Rated Life Time	Proposed California Effective Date
100 Watts	72 Watts	1,000 hours	Jan, 1, 2011
75 Watts	53 Watts	1,000 hours	Jan 1, 2012
60 Watts	43 Watts	1,000 hours	Jan 1, 2013
40 Watts	29 Watts	1,000 hours	Jan 1, 2013

Lumens Range	Maximum Lamp Efficacy	Minimum Rated Life Time	Proposed California Effective Date
All	45 lumens per watt	1,000 hours	Jan, 1, 2018



Title 20 Appliance Efficiency Regulations Metal Halide Luminaires

- January 2006 California “Tier 1”
- January 2008 California “Tier 2”
- January 2009 Federal Regulations
- January 2010 California



Title 20 Appliance Efficiency Regulations Metal Halide Luminaires

Metal halide luminaires rated for 150 to 500 watts, manufactured on or after January 2010 through January 2015

Menu of compliance options

- High efficiency ballast
- Moderate efficiency ballast + integral controls
- Moderate efficiency ballast + non-conventional wattages
- Moderate efficiency ballast + prepackaged & sold with high efficiency lamp (this option only available 336 through 500 watt lamps)



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Title 24 - 2008

General Information



2008 Title 24

Adopted

- April 23, 2008

Effective

- January 1, 2010
 - For building permits filed on or after January 1, 2010



2008 Title 24

Documents are available on-line

www.energy.ca.gov

☒ Efficiency

☒ Building Efficiency Standards (Title 24)

☒ 2008 Standards

- *Standards*
- *Compliance Manuals (Residential and Nonresidential)*
- *Appendices*
- *ACM*



§ 101 Definitions

- Many new definitions added
- Clarifications made to existing definitions
- Many T24 inquiries are answered by taking folks to the definition section



DEFINITIONS § 101

Permanently Installed Lighting

2005

2008

All luminaires attached to the inside or outside of a building or site, including:

- Track and flexible lighting system
- Attached to walls, ceilings, columns
- Inside or outside of permanently installed cabinets
- Internally illuminated case work
- Mounted on poles, in trees or in the ground
- Attached to ceiling fans
- Integral to exhaust fans that are other than exhaust hoods for cooking equipment

(continued on next page)



DEFINITIONS § 101

Permanently Installed Lighting

(continued from previous page)

2005

2008

- **May have either plug-in or hardwired connections for electric power**
- Does not include
 - Portable lighting
 - Lighting installed by the manufacturer in refrigerators, stoves, microwave ovens, exhaust hoods for cooking equipment, refrigerated cases, vending machines, food preparation equipment, and scientific and industrial equipment.



DEFINITIONS § 101

Portable Lighting

2005

2008

- Lighting with plug-in connections for electric power that is
 - Table lamps
 - Freestanding floor lamps
 - Attached to modular furniture
 - Workstation task lights
 - Lights attached to workstation panels, movable displays
 - Other lighting that is not permanently installed lighting.



DEFINITIONS § 101

Temporary Lighting	
2005	2008
<ul style="list-style-type: none">Temporary connections, such as cord and plug, are used for electric power	<ul style="list-style-type: none">With plug-in connections
<ul style="list-style-type: none">Does not persist beyond 60 consecutive days or more than 120 days per year.	



DEFINITIONS § 101 (Residential Space Type)

2005	2008
<ul style="list-style-type: none">Bathroom is a room containing a shower, tub, toilet or sink used for personal hygiene.	<ul style="list-style-type: none">Bathroom is a room or area containing a sink used for personal hygiene, toilet, shower, or a tub.
	<ul style="list-style-type: none">Closet is a non-habitable room used for the storage of linens, household supplies, clothing, non-perishable food, or similar uses, and which is not a hallway or passageway.



DEFINITIONS § 101 (Residential Space Type)

2005	2008
	<ul style="list-style-type: none">Laundry is a non-habitable room or space which contains plumbing and electrical connections for a washing machine or clothes dryer.
	<ul style="list-style-type: none">Storage Building is a non-habitable detached building used for the storage of tools, garden equipment, or miscellaneous items.
	<ul style="list-style-type: none">Utility Room is a non-habitable room or building which contains only HVAC, plumbing, or electrical controls or equipment; and which is not a bathroom, closet, garage, or laundry room.



DEFINITIONS § 101 (Residential Space Type)

2005	2008
Low-Rise Residential Building	
Is a building, other than a hotel/motel that is of Occupancy Group R, Division I, and is multi-family with three stories or less, or that is of Occupancy Group R, Division 3	Is a building, other than a hotel/motel that is of Occupancy Group R, division I, and is multi-family with three stories or less, or a single family residence of Occupancy Group R, Division 3, or an Occupancy Group U building located on a residential site



DEFINITIONS § 101 (Residential Space Type)

2005	2008
	<ul style="list-style-type: none">Garage is a non-habitable building or portion of building, attached to or detached from a residential dwelling unit, in which motor vehicles are parked.
<ul style="list-style-type: none">Kitchen is a room or area used for cooking, food storage and preparation and washing dishes, including associated counter tops and cabinets, refrigerator, stove, ovens, and floor area.	



Luminaire Efficacy and Wattage is NOT based on the initial lamp installed

Based on Rating of the Socket

- Luminaire input wattage is based upon the type and rating of the luminaire, not the type of lamp initially installed in a luminaire
- A high efficacy lamp screwed into a low efficacy luminaire is still be considered to be a low efficacy lighting system for Title 24 projects



Rules for Determining Wattage §130(d)

Luminaire wattage shall be determined as follows...

...or by a method approved by the Executive Director

Therefore, supplemental information in Compliance Manuals is relevant.



Rules for Determining Wattage §130(d)

Line-Voltage Incandescent Luminaires

- Line voltage lamp holders & no ballasts or transformers
- Other than GU-24
- Other than recessed

Rules to determine wattage:

- Maximum relamping rated wattage as listed on a permanent, pre-printed, factory-installed label





Rules for Determining Wattage §130(d)

Line-Voltage Incandescent Luminaires - continued

For RECESSED luminaires with screw-base line-voltage lamp holders shall be the larger of

- Relamping rated wattage, or
- 50 watts per socket for $< 5''$ aperture diameter regardless of mounting height
- 50 watts per socket for $\geq 5''$ aperture diameter and mounting height ≤ 11 feet
- 60 watts per socket for $\geq 5''$ aperture diameter and mounting height > 11 and < 15 feet
- 75 watts per socket for $\geq 5''$ aperture diameter and mounting height ≥ 15 feet





Rules for Determining Wattage §130(d)

Modular Luminaires

- Luminaires designed to accommodate a variety of trims without changing wiring shall be highest wattage designated by the correlated marking
- Line voltage: **Label shall not consist of peel-off or peel-down layers**





Rules for Determining Wattage §130(d)

Ballasts

- Permanently / remotely installed ballasts = operating input wattage of the rated lamp/ballast combination published in manufacturer's catalogs based on independent testing lab reports as specified by UL 1598
- CFL or HID luminaires that accommodate a range of wattages without changing the luminaire housing, ballast, or wiring shall be the larger of the installed lamp/ballast combination, or the average lamp/ballast combination for which the luminaire is rated.

1	26	50/10	120	REZ-1T42-M2-XX①②	✓	✓	0.26	31/8	1.00/ 0.05	10	0.98	Size 2/ 168
			277	VEZ-1T42-M2-XX①②	✓	✓	0.11					
2	26	50/10	120	REZ-2Q26-M2-XX①②	✓	✓	0.48	58/16	1.00/ 0.05	10	0.98	Size 2/ 168
			277	VEZ-2Q26-M2-XX①②	✓	✓	0.21					



Rules for Determining Wattage §130(d)

EXAMPLE: Multi-Wattage CFL Ballasts

Use higher of:

- Installed wattage, or
- Average wattage

Lamp Wattage

- 26
- 32
- 42

If 26 or 32 Watt lamps installed:

- Use average = 33.3 Watts

If 42 watt lamp installed:

- Use 42 Watts



Rules for Determining Wattage §130(d)

Line-voltage Track and Plug-in Busway

Rated > 20 Amperes

- VA rating of the branch circuit. (*only option available for > 20 ampere*)





Rules for Determining Wattage §130(d)

Line-voltage Track and Plug-in Busway

Rated for 20 Amperes or Less (4 options for determining wattage)

Option 1 - VA rating of branch circuit

Option 2 - Higher of

- connected load, or
- 45 watts linear foot

Option 3 - Higher of

- VA rating certified integral current limiter, or
- 12.5 watts per linear foot.

Note: Integral current limiter must be certified to the Energy Commission. If product is not listed on CEC appliance database, product is not certified.



Rules for Determining Wattage §130(d)

Line-voltage Track and Plug-in Busway Rated for 20 Amperes or Less continued

Option 4 - Sum of ampere rating of all overcurrent protection devices times branch circuit voltage in a dedicated track lighting **supplementary overcurrent protection panel**





Rules for Determining Wattage §130(d)

Specific requirements for dedicated track lighting supplementary overcurrent protection panel

- Listed as defined in § 101
- Use only with line voltage track lighting
- Be permanently installed in an electrical equipment room, or adjacent to lighting panel board providing supplementary overcurrent protection for the track lighting circuits served
- Be prominently labeled “NOTICE: This Panel for Track Lighting Energy Code Compliance Only. The overcurrent protection devices in this panel shall only be replaced with the same or lower amperage. No other overcurrent protective devices shall be added to this panel. Adding to, or replacement of existing overcurrent protective device(s) with higher continuous ampere rating will void the panel listing and require re-submittal and re-certification of California Title 24, Part 6 compliance documentation”





Rules for Determining Wattage §130(d)

Low Voltage

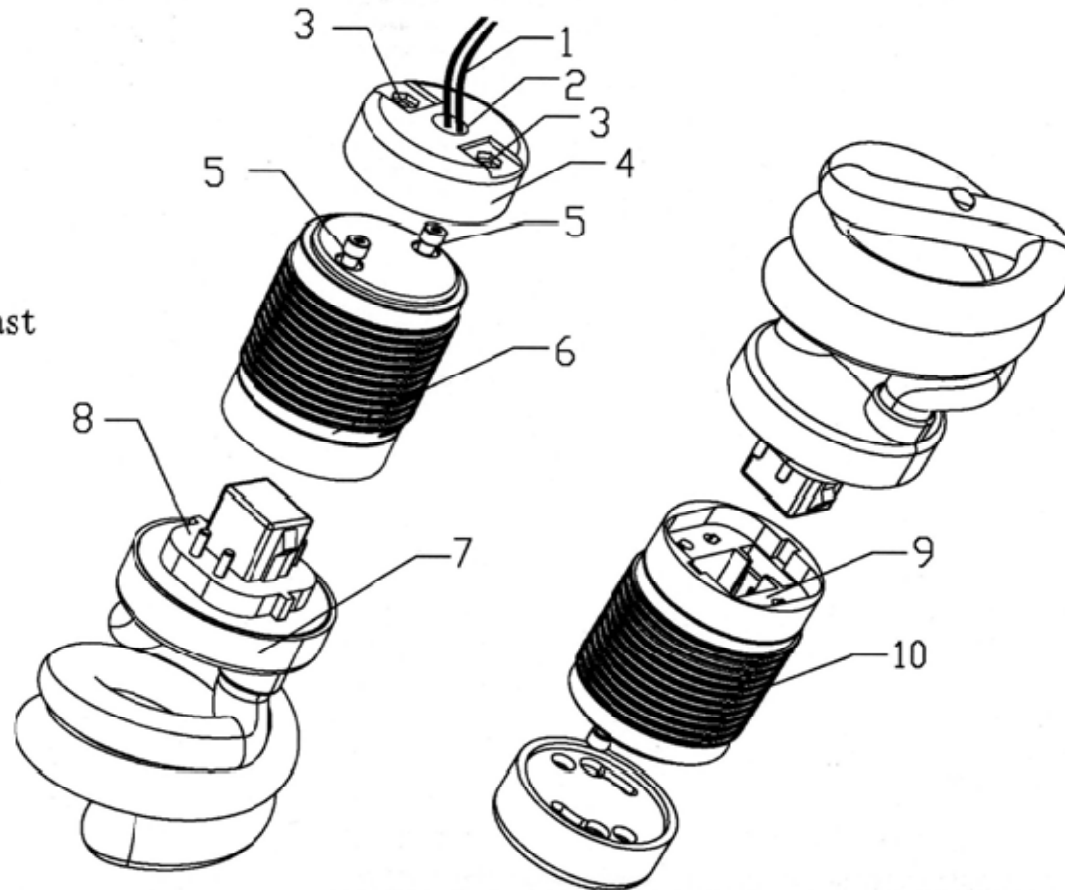
- Luminaires or lighting systems with permanently installed or remotely installed transformers shall be the rated wattage of the lamp / transformer combination supplying the system (applies to track and individual luminaires)
- Where transformer rated > 53 watts, label shall not consist of peel-off or peel-down layers





What is a GU-24 ?

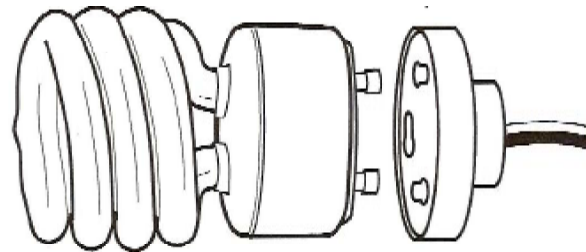
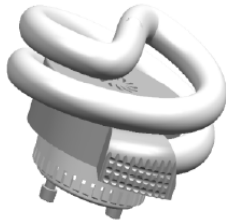
1. Lead Wire
2. Fixing Hole I
3. Fixing Holes II
4. Base
5. Prongs
6. Replacement Ballast
7. Replacement Lamp
8. Lamp Base
9. Lamp Holder
10. Thread





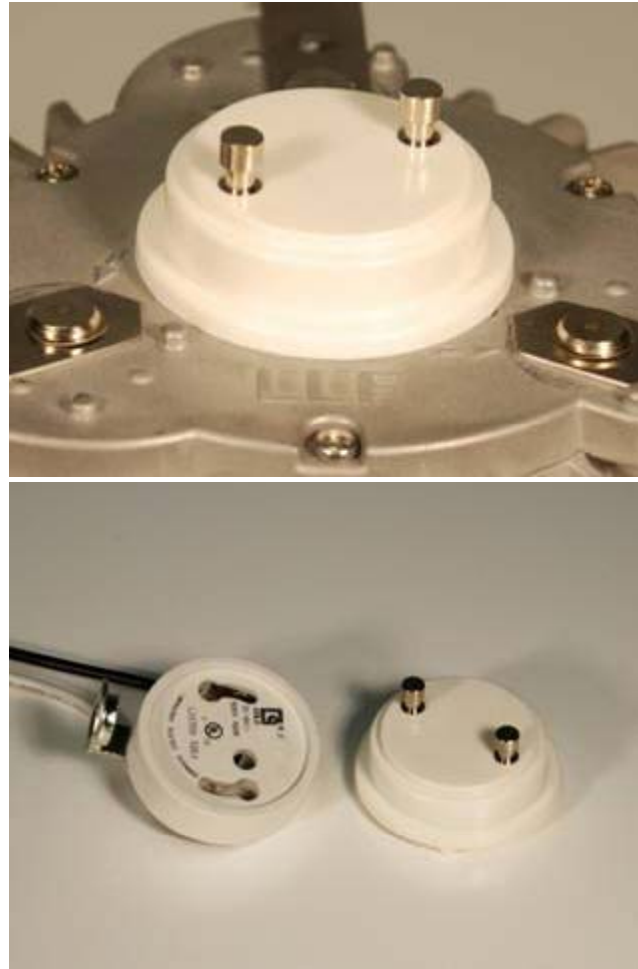
CALIFORNIA ENERGY COMMISSION

What is GU-24 ?





What is GU-24 ?





GU-24 Requirements §130(e)

GU- 24 Products

- The Standards do not promote or discourage the use of GU-24 products

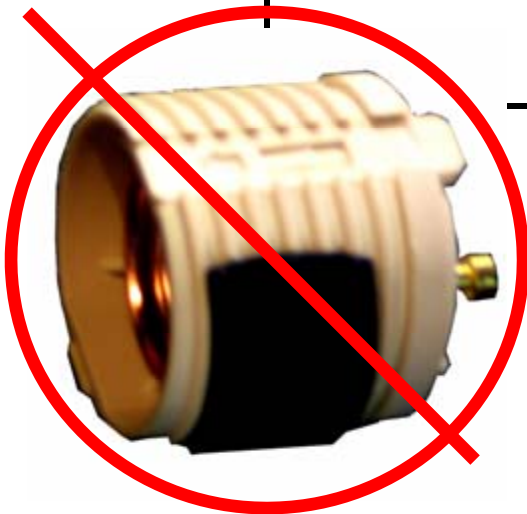


GU-24 Requirements §130(e)

Title 24 Rules for Determining Luminaire Wattage §130(e)

GU-24 Lamps, luminaires, and adaptors installed in California shall not be low efficacy as follows:

- No GU-24 low efficacy lamps
- No GU-24 low efficacy luminaires
- No GU-24 modular adaptors or luminaire conversions





GU-24 Requirements - Title 20

Title 20 (Appliance Efficiency Regulations adopted December 3, 2008)
It is against the laws of the State of California to sell any of the following products in California
<ul style="list-style-type: none">• Incandescent lamps with GU-24 bases.• GU-24 adaptors that adapt a GU-24 socket to any other line-voltage socket.• Luminaires that are equipped with GU-24 sockets which are rated for incandescent lighting of any kind (including low-voltage or high-voltage.)



GU-24 Requirements

Nowhere in the Standards does Title 24 recognize any type of “permanent” screw-based adaptors

- High efficacy luminaires, for compliance with Title 24, shall not contain screw-base sockets according to §150(k).
- If a luminaire contains a screw-base socket it is not recognized as high efficacy by T24, regardless of manufacturer claims.
- Title 24 does not recognize any “permanent” line-voltage adaptors..



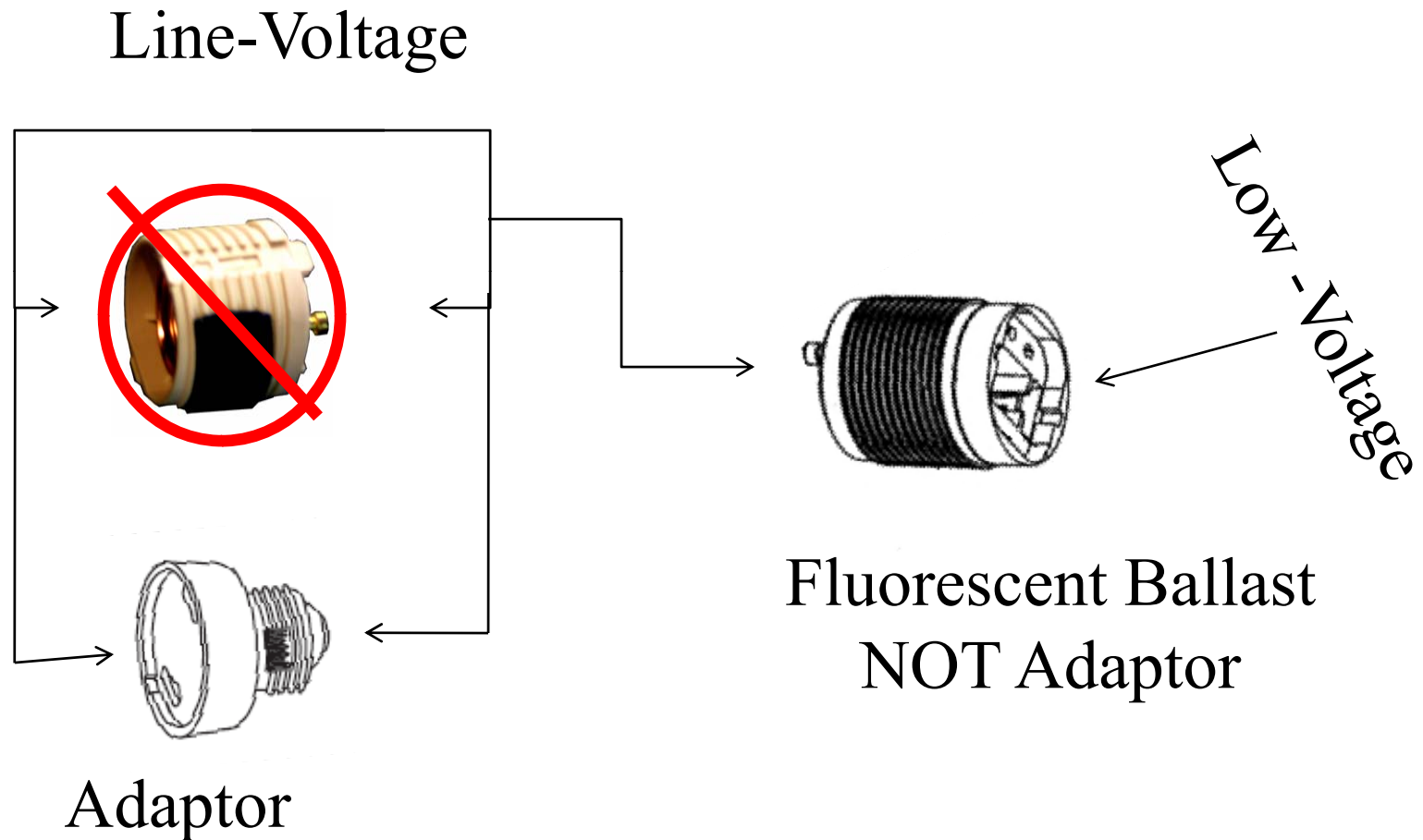


GU-24 Requirements

Nowhere in the Standards does Title 24 recognize any type of “permanent” screw-based adaptors

- Adaptors are NOT recognized by Title 24 as converting a low efficacy luminaire to a high efficacy luminaire.
- A luminaire with a screw-based socket will always be classified as an incandescent luminaire, even if a “permanent” adaptor is installed in the luminaire.







Are there any applications in California that allow screw-based to GU-24 sockets to be used?

- Yes, but only for projects which are not regulated by Title 24 building standards, which include:
 - Existing lighting systems, in existing buildings, which are not part of a Title 24 project.
 - Repairs (replacement of lamps, ballasts, or lenses, which do not involve replacing the fixture), and which are not part of a Title 24 project.





CALIFORNIA ENERGY COMMISSION

Changes to 2008 Title 24 Residential Lighting Standards



High Efficacy Luminaires § 150(k)

- ALL luminaires installed in RESIDENTIAL applications must be classified as high efficacy or low efficacy
- Luminaires installed in nonresidential applications not classified as high efficacy or low efficacy



How to Determine High Efficacy § 150(k) Use total system watts for LED lighting

From Table 150-C	
Wattage Range	Minimum Lumens/Watt
≤ 5 W	30 L/W
> 5 W to 15 W	40 L/W
> 15 W to 40 W	50 L/W
> 40 W	60 L/W





Residential Lighting Standards § 150(k)

How to Calculate System Efficacy

2005

2008

- Efficacy = initial lumens ÷ watts



EXCEPT for LED systems

- LED = system watts (lamp, transformer, power supply & fan...)
- LED must be certified to Commission to be classified as high efficacy





Residential Lighting Standards § 150(k)

Definition of a High Efficacy Luminaire

- Contains only high efficacy lamps
- **Does not contain any medium screw base sockets**
- Is not a low efficacy luminaire as specified in §150(k)



Residential Lighting Standards § 150(k)



Definition of Low Efficacy Lighting

2005	2008
	<ul style="list-style-type: none">Any luminaire that does not qualify as high efficacyAny luminaire containing a medium screw-base socket (E24/E26)Any luminaire containing any type of line-voltage socket <p>Except GU-24 under certain conditions</p>





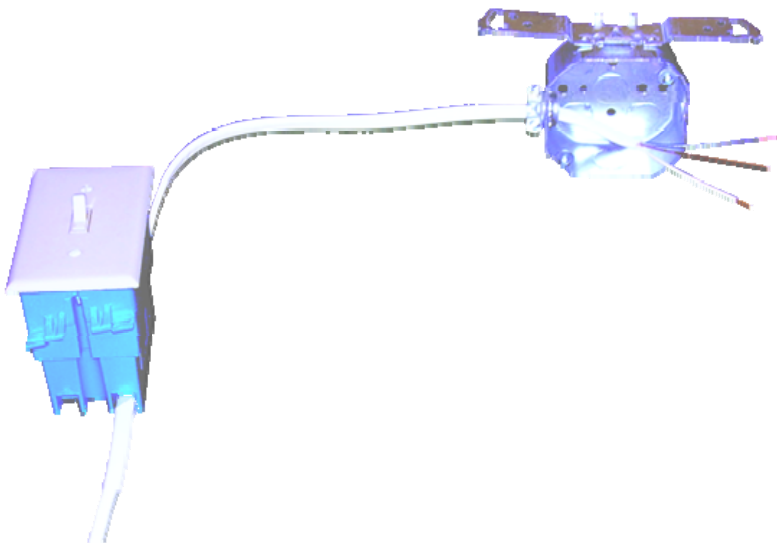
Residential Lighting Standards § 150(k)



Definition of Low Efficacy Lighting continued

2008

- Low voltage incandescent lighting
- Track lighting
- Lighting with modular adaptors which accommodate low efficacy lighting
- Blank electrical boxes





How to Determine High Efficacy § 150(k)

Only Conditions Where LED Qualifies As High Efficacy.

- Meets minimum high efficacy requirements of Table 150(c)
- Includes power supply, transformer, fans
- Based on independent testing lab report in accordance with Reference Joint Appendix 8 (JA8)
- Must be Certified to Energy Commission as high efficacy according to § 119(m)





Residential Lighting Standards § 150(k)

Only Conditions Where GU-24 Can Qualify As High Efficacy.

- Luminaire has only factory installed GU-24 lamp sockets, and
- Luminaire is not a CFL recessed downlight, and
- No other types of line voltage sockets are in the luminaire, and
- The manufacturer does not provide adaptors to convert GU-24 socket to any other line voltage lamp holder, and
- Luminaire is rated only for high efficacy lighting systems according to Table 150-C.



Residential Compliance Manual Chapter 6.2.10

- An LED source system with a standardized base is an LED lamp
- Does not qualify as a high efficacy luminaire





How to Certify LED lighting to the Energy Commission

Certification completed by manufacturers:

- Includes declaration of compliance, executed under penalty of perjury of the laws of California
- Database of certified devices, and certification instructions are available from the following web link:

<http://www.energy.ca.gov/appliances/appliance/index.html>



Title 24 IS NOT Energy Star

- California Title 24 requirements ARE NOT subject to Energy Star requirements
- Energy Star specifications cannot be used in lieu of California Title 24 specifications



Requires independent testing lab reports

Additional language in 2008 Residential Compliance Manual supplements the Title 24 testing language

- IES LM-79-08 is allowed as an alternate test method, provided that:
 - Wattage is determined in accordance with JA-8.2
 - Testing lab is accredited in accordance with JA-8.2(c)
 - Efficacy is calculated in accordance with JA-8.4



Continuing Efforts Related to LED Lighting

Background:

- There will continue to be both high efficacy and low efficacy LED lighting, as defined by Title 24, for the foreseeable future
- Two most common formats for LED lighting systems available today are:
 - Dedicated LED luminaires
 - LED “trims”

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





Continuing Efforts related to LED Lighting

Background continued:

- Many manufacturers of LED trims currently install their LED trims into someone else's luminaire. They do not manufacture their own luminaire housing
- These third-party luminaire housings are typically classified as low efficacy according to Title 24
- So as to not impede high efficacy LED lighting systems from the market, the Energy Commission has options in the 2008 Residential Compliance Manual to address conditions high efficacy LED trims, when installed into low efficacy luminaires, may be classified as high efficacy
- These issues are unique to LED trims. Therefore, the solution must apply only to LED trims, and not to any other lighting technology. For example, it shall not apply to CFL trims.



Continuing Efforts related to LED Lighting

Background continued:

- Field modified luminaires may lose their UL listing
- These UL issues will have to be settled with UL. This is not a Title 24 Building Energy Efficiency Standards issue.



Continuing Efforts related to LED Lighting

- Following is language in the 2008 Residential Compliance Manual:
 - The UL listing of the luminaire housing must be addressed with UL
 - The LED trim must be certified to the Energy Commission as high efficacy according to Table 150-C, or it shall be considered low efficacy.
 - The LED trim must be hardwired directly into the luminaire housing. The wiring assembly may include some kind of mid-line connection, like a GU-24, or other such connector between the LED trim and the wire ends used to hardwire the assembly to the housing.

However, under no circumstances shall the connection include a screw-base.

Continued on next page



Continuing Efforts related to LED Lighting

- Following is language in the 2008 Residential Compliance Manual:
 - The luminaire housing cannot contain any type of screw-base socket.
 - Screw-base adaptors shall not be used, even if the manufacturer considers them to be “permanent”
 - An LED trim, provided by the manufacturer with a screw-base “pig-tail,” shall NOT be installed unless the base is cut off and discarded prior to installation, and the trim must be permanently hardwired into the luminaire



Multiple-LED Luminaires connected to a Single Power Supply

Additional information in the 2008 Nonresidential Compliance Manual:

- 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 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.



Residential Lighting Standards § 150(k)

Only Condition Where Medium Screw Base Socket Can Qualify As High Efficacy.

2005	2008
<ul style="list-style-type: none">• Only for manufactured high intensity discharge (HID) luminaire, and• Must meet minimum lumens per watt of Table 150-C, and• Factory-installed HID ballast, and• HID rated socket	
<ul style="list-style-type: none">• Only outdoor	<ul style="list-style-type: none">• Outdoor or indoor





Residential Lighting Standards § 150(k)

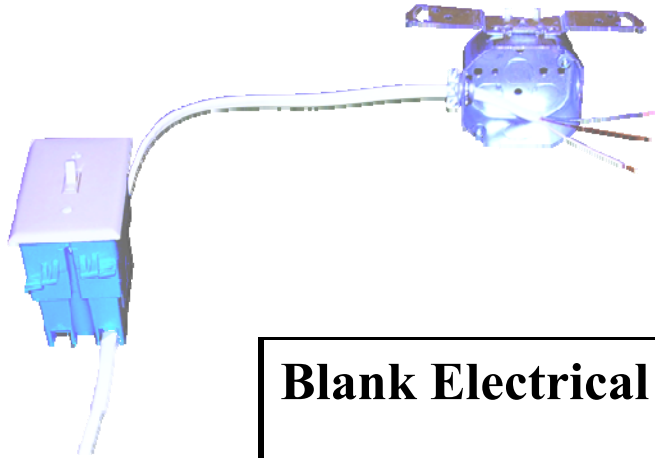
Electronic ballasts required for lamps rated 13 watts or greater

2005	2008
<ul style="list-style-type: none">To qualify as a high efficacy luminaire	<ul style="list-style-type: none">For all luminaires





Residential Lighting Standards § 150(k)



Blank Electrical Boxes in Kitchen

2008

- Shall be calculated and treated as 180 watts of low efficacy lighting



Residential Lighting Standards § 150(k)

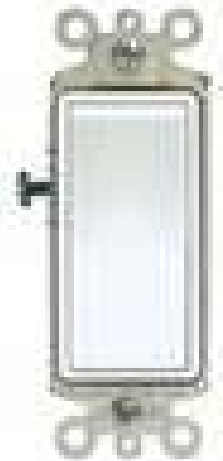
Switching Requirements

2005

2008

- High efficacy / low efficacy lighting systems must be separately switched
- Controls must be installed according to manufacturer instructions

- Exhaust fans switched separately from lighting. Exception: light switched manually on/off in conjunction with an auto time-out switch on fan.
- All controls permit manual on and off
- No override of dimmer or vacancy sensor installed to comply with § 150(k)
- Controls are certified per § 119





Residential Lighting Standards § 150(k)

Permanently Installed Night Lights and Night Lights Integral to Permanently Installed Luminaire or Exhaust Fan

2005

2008

1. Shall contain only high efficacy lamps with no line voltage lamp holder
or
2. Shall consume no more than 5 watts with no screw-base lamp holder.

Indicator lights that are integral to lighting controls shall consume no more than 1 watt





Residential Lighting Standards § 150(k)

Recessed luminaires in insulated ceilings Zero-Clearance IC	
2005	2008
<ul style="list-style-type: none">• Must be approved for zero-clearance insulation cover (IC)	





Residential Lighting Standards § 150(k)

Recessed luminaires in insulated ceilings

Airtight

2005

2008

- Must be certified airtight (ASTM E283)
- Sufficiently airtight to prevent the flow of heated or cooled air between conditioned and unconditioned spaces
- Gasket or caulk between luminaire and ceiling
- All air leak paths through luminaire assembly or ceiling opening must be sealed



Residential Lighting Standards § 150(k)

Recessed luminaires in insulated ceilings	
BALLASTS	
2005	2008
	<ul style="list-style-type: none">• To qualify as high efficacy ballasts shall be certified to comply with Section 119(n)• Must allow ballast maintenance and replacement readily accessible from below the ceiling without cutting holes in ceiling.



Residential Lighting Standards § 150(k)

Bathroom Exhaust Fans

2005

2008

- Lighting subject to lighting Standards
- Fan housing not required to be certified airtight
- Gasket or caulk required between exhaust fan housing and ceiling.





Residential Lighting Standards § 150(k)

Definition of a Kitchen	
2005	2008
<ul style="list-style-type: none">• Kitchen in a residential dwelling unit is a room or area used for cooking, food storage and preparation and washing dishes, including associated counter tops and cabinets, refrigerator, stove, ovens, and floor area.	
<ul style="list-style-type: none">• Adjacent areas are considered Kitchen if the lighting for the adjacent areas is on the same switch as the lighting for the Kitchen.	



Residential Lighting Standards § 150(k)

Lighting Internal to Cabinets

2005	2008
<ul style="list-style-type: none">• IS considered part of the kitchen lighting for calculating 50%	<ul style="list-style-type: none">• NOT considered part of the kitchen lighting for calculating 50%• Shall use no more than 20 W/ linear foot of illuminated cabinet

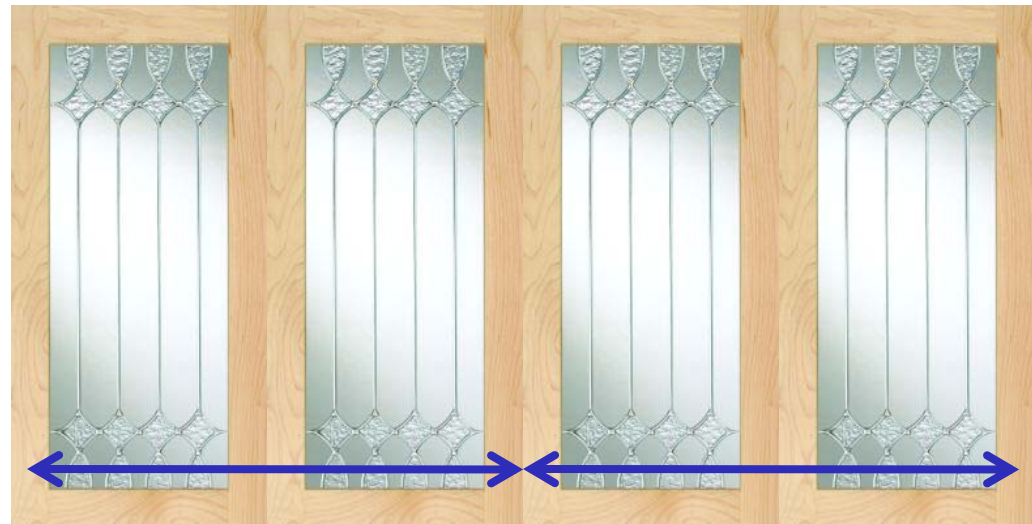




Internally Illuminated Cabinets



You may use either the width of the cabinet section or the height of the glazing per cabinet section, regardless of the number of shelves or doors on the cabinet.





Residential Lighting Standards § 150(k)

Kitchen Lighting Wattage	
2005	2008
<ul style="list-style-type: none">• $\geq 50\%$ of installed wattage must be high efficacy	
	<ul style="list-style-type: none">• Additional low efficacy wattage may be available under certain conditions (<i>see next 2 slides</i>)



Residential Lighting Standards § 150(k)

**Additional Low Efficacy Kitchen Lighting Wattage
Exempt from 50% High Efficacy Requirement
Only When All Conditions Have Been Met
(See next slide)**

2005	2008
	<ul style="list-style-type: none">• Up to 50 watts per dwelling units $\leq 2,500 \text{ ft}^2$
	<ul style="list-style-type: none">• Up to 100 watts per dwelling units $> 2,500 \text{ ft}^2$



Residential Lighting Standards § 150(k)

All Conditions Required to qualify for Additional Kitchen Low Efficacy Lighting Wattage

2005

2008

1. All low efficacy luminaires in Kitchen controlled by vacancy sensor, dimmer, EMCS, or multi-scene programmable control, and
2. All luminaires in garages, laundry, closets $> 70 \text{ ft}^2$, utility rooms must be high efficacy AND also must be controlled by a vacancy sensor





Residential Lighting Standards § 150(k)

Bathrooms, Garages, Closets Laundry Rooms, and Utility Rooms

2005

- bathrooms, garages, closets, laundry rooms, and utility rooms

2008

- bathrooms, **attached and detached** garages, closets, laundry rooms, and utility rooms

All installed lighting must be

- high efficacy, or
- controlled by a vacancy sensor certified to CEC

Low efficacy luminaires allowed in closets less than 70 ft²



Residential Lighting Standards § 150(k)

For all other rooms

(Any room that is not a Kitchen, Bathroom, Garage, Laundry Room, or Utility Room)

2005

2008

All hardwired lighting must be

- high efficacy, or
- controlled by a vacancy sensor, or
- controlled by a dimmer

- Lighting in detached storage buildings less than 1000 square feet located on a residential site not required to comply.





Residential Lighting Standards § 150(k)

Outdoor lighting attached to a building

2005	2008
<ul style="list-style-type: none">All outdoor lighting attached to buildings must be high efficacy, or	
controlled by both a motion sensor and an integral photocontrol	<ul style="list-style-type: none">controlled by a motion sensor in addition to one of the following methods:
	<ul style="list-style-type: none">Photocontrol not having an override or bypass switch, orAstronomical time clock not having an override or bypass switch, orEnergy management control system (EMCS) not having an override or bypass switch that allows the luminaire to be always on.



Residential Lighting Standards § 150(k)

Outdoor lighting attached to a building

2005

2008

- Exception to high efficacy: Outdoor luminaires in or around swimming pools, water features, or other locations subject to Article 680 of the California Electric Code

Summary of Article 680 is in the Residential Compliance Manual

Low efficacy outdoor luminaires may have temporary override switch which bypasses the motion sensing function for up to six hours provided that the override switch automatically reactivates the motion sensor.



Residential Lighting Standards § 150(k)

Outdoor Lighting for High-rise Residential Dwelling Units and Hotel/Motel Guest Rooms

if separately controlled from the inside of a high-rise residential dwelling unit or guest room



2005	2008
	<ul style="list-style-type: none">T24 Standards: ...shall comply with Section 150(k)12.



Residential Lighting Standards § 150(k)

Residential parking lots and garages for 8 or more vehicles

2005

2008

Must meet the lighting requirements for nonresidential buildings, which may include:

- Automatic shutoff controls
- Bi-level switching
- > 175W cutoff
- Minimum efficacy or motion sensor
- Lighting power allowances per Lighting Zone (LZ)



Residential Lighting Standards § 150(k)

Common Areas of low-rise residential buildings with 4 or more dwelling units

2005

2008

- All hardwired lighting must be high efficacy or controlled by an occupant sensor.



Residential Lighting Standards § 150(k)

Internally illuminated address signs	
2005	2008
Interpretation: Shall comply with Sign Standards (§148)	Shall comply with Sign Standards (§148)
<ul style="list-style-type: none">• 12 watts per square foot internal illumination• 2.3 watts per square foot external illumination OR <ul style="list-style-type: none">• Alternative option: Equipped only with one or more of the light sources shown on the next slide	



Residential Lighting Compliance Forms

2005	2008
<p>MF-1R</p> <ul style="list-style-type: none">• Mandatory Measure Summary• Includes <u>checklist</u> for residential lighting measures	<p>MF-1R</p> <ul style="list-style-type: none">• Mandatory Measures Summary• Includes <u>summary</u> of residential lighting measures
<p>WS-5R</p> <ul style="list-style-type: none">• Residential Kitchen Lighting Worksheet• Documents failed to say form must be submitted	<p>CF-6R-LTG-01</p> <ul style="list-style-type: none">• Installation Certificate for residential lighting• Residential Compliance Manual says this form must be submitted for <u>any and all</u> lighting measures



CALIFORNIA ENERGY COMMISSION

Nonresidential Indoor Lighting Controls



§ 119 Lighting Control Devices

Mandatory requirements for lighting control devices	
2005	2008
<ul style="list-style-type: none">• Mandatory requirements for lighting control devices	<ul style="list-style-type: none">• Mandatory requirements for lighting control devices, ballasts, and luminaires
	<ul style="list-style-type: none">• May be individual devices or systems consisting of 2 or more components• For systems with 2 or more components, such as EMCS, manufacturer shall certify each of the components required for system to comply with §119



§ 119 Lighting Control Devices

Mandatory requirements for lighting control devices	
2005	2008
	<ul style="list-style-type: none">Indicator lights integral to lighting control devices shall consume ≤ 1.0 W per indicator light.
Occupant Sensors and Motion Sensors	<ul style="list-style-type: none">Occupant Sensors, Motion Sensors, and Vacancy Sensors....and shall have a visible status signal that indicates the device is operating properly or has failedVisible status signal may have override switch that turns the signal off.



§ 119 Lighting Control Devices

Mandatory requirements for lighting control devices	
2005	2008
	<p>Dimmers shall</p> <ul style="list-style-type: none">• Be capable of reducing power consumption $\geq 65\%$ when at its lowest light level• If controlling incandescent or fluorescent lamps, provide electrical outputs to lamps for reduced flicker• Be listed by a rating lab recognized by ICC as being in compliance with UL• continued on next slide...



§ 119 Lighting Control Devices

Mandatory requirements for lighting control devices	
2005	2008
	<p>Dimmers shall</p> <ul style="list-style-type: none">• If 3-way wall box dimmer designed for use with non-dimmable switches, dimmer setting shall not be overridden by any switches in the circuit• Dimmer & all switches shall have capability of turning lighting OFF if it is ON, and turning lighting ON to the level set by dimmer if lighting is OFF• Any wall box dimmer connected to system with emergency override function shall be controlled by emergency override.• If stepped dimmer, shall include off position to turn lights completely off.



§ 119 Lighting Control Devices

Mandatory requirements for lighting control devices

2005	2008
In 2005 Nonres Manual	<p>Track Lighting Integral Current Limiter shall:</p> <ul style="list-style-type: none">• Be designed so integral current limiter housing permanently attached to track so track irreparably damaged if integral current limiter housing removed after installation• Have VA rating clearly marked on the circuit breaker visible for building officials' field inspection without opening coverplates, fixtures, or panels, and also on permanent factory-installed label inside the wiring compartment• Employ tamper resistant fasteners for cover to wiring compartment• Have conspicuous permanent factory installed label affixed inside wiring compartment warning against removing, tampering with, rewiring, or bypassing the device.



§ 119 Lighting Control Devices

Mandatory requirements for lighting control devices	
2005	2008
	<p>Dimmable Fluorescent Ballasts for Power Adjustment Factor</p> <ul style="list-style-type: none">• To qualify for the PAF:• Ballasts for T5 and T8 lamps shall be electronic, and• Dimmable, and• Meet the minimum RSE in Table 146-D.



§ 131 Indoor Lighting Controls

(a) Area Controls	
2005	2008
2. Other devices may be installed in conjunction with the switching or control device provided that they A, permit the switching or control device to	
• override action of all other devices...	• manually turn the lights off...



§ 131 Indoor Lighting Controls

Exceptions to Section 131(a) [Area Controls]	
2005	2008
<ul style="list-style-type: none">Up to 0.5 W/ft²...for reasons of building security or emergency egress, if:	<ul style="list-style-type: none">Up to 0.3 W/ft²...for reasons of building security or emergency egress, if:
<ul style="list-style-type: none">The area is controlled by switches accessible only to authorized personnel	<ul style="list-style-type: none">The security or egress lighting is controlled by switches accessible only to authorized personnel



§ 131 Indoor Lighting Controls

(b) Multi-Level Lighting Controls	
2005	2008
<ul style="list-style-type: none">...shall have at least one control step that is between 50% and 70%	<ul style="list-style-type: none">...shall have at least one control step that is between 30% and 70%
<ul style="list-style-type: none">...at least one step... < 35% full rated lighting system power	<ul style="list-style-type: none">35% language removed
	<ul style="list-style-type: none">...allow the power of all lights to be manually turned off.



§ 131 Indoor Lighting Controls

(d) Shut-off Controls	
2005	2008
<ul style="list-style-type: none">• For every floor...automatic controls to shut off the lighting	<ul style="list-style-type: none">• In addition to the manual controls installed to comply with Section 131(a) and (b), for every floor...
<ul style="list-style-type: none">• Exceptions to Section 131(d)1 Lighting in corridors, guestrooms...	<ul style="list-style-type: none">• Exceptions to Section 131(d)1 Lighting in corridors, guestrooms...and parking garages



§ 131 Indoor Lighting Controls

(d) Shut-off Controls	
2005	2008
<ul style="list-style-type: none">Up to 0.5 W/ft²..for security or emergency egress.	<ul style="list-style-type: none">Up to 0.3 W/ft²..for security or emergency egress...provided area designated as security or emergency egress area on the plans and specifications...
<ul style="list-style-type: none">If an automatic time-switch control device is installed to comply...	<ul style="list-style-type: none">If an automatic control device is installed to comply...



§ 131 Indoor Lighting Controls

(d) Shut-off Controls	
2005	2008
	<ul style="list-style-type: none">• Occupancy sensor required as compliance method for :<ul style="list-style-type: none">✓ Offices ≤ 250 ft²✓ Multipurpose room < 1000 ft²✓ Classrooms any size✓ Conference rooms any size• Shall allow lights to be manually shut off regardless of sensor status.



§ 131 Indoor Lighting Controls

(e) Display Lighting	
2005	2008
<ul style="list-style-type: none">• Display lighting shall be separately switched on circuits that are ≤ 20 A	<ul style="list-style-type: none">• Floor and wall display lighting• Window display lighting• Case display lighting<ul style="list-style-type: none">✓ Shall each be separately switched on circuits that are ≤ 20 A



§ 131 Indoor Lighting Controls

(f) Automatic Controls Required for Tailored Method	
2005	2008
	<ul style="list-style-type: none">When the Tailored Method used for calculating allowed indoor LPD, general lighting shall be controlled separately from display, ornamental, and display case lighting.



§ 131 Indoor Lighting Controls

(g) Demand Responsive Lighting Controls	
2005	2008
	<ul style="list-style-type: none">• Retail buildings with sales floor areas $> 50,000 \text{ ft}^2$<ul style="list-style-type: none">✓ Require automatic demand responsive lighting controls✓ Uniformly reduce lighting power consumption $\geq 15\%$• EXCEPTION: Buildings where $> 50\%$ lighting power controlled by daylighting controls.



§ 134 Indoor Lighting Controls

§131(f) Lighting Control Acceptance...

has been moved to §134

2005

2008

- | | |
|--|---|
| <ul style="list-style-type: none">• Before an occupancy permit is granted for a new building or space, or a new lighting system serving a building or space is operated for normal use.. | |
| <ul style="list-style-type: none">• all lighting controls... | <ul style="list-style-type: none">• all indoor and outdoor lighting controls... |
| <ul style="list-style-type: none">• ...serving the building, space, or site shall be certified as meeting the Acceptance Requirements for Code Compliance. | |



§ 134 Indoor Lighting Controls

§134 Lighting Control Acceptance...continued	
2005	2008
<ul style="list-style-type: none">• A Certificate of Acceptance shall be submitted to the building department that certifies:	<ul style="list-style-type: none">• A Certificate of Acceptance shall be submitted to the enforcement agency...that certifies:
<ul style="list-style-type: none">• plans, specifications, installation certificates, and operating and maintenance information meet [T24]	
<ul style="list-style-type: none">• lighting controls meet requirements of [T24]	



§ 134 Indoor Lighting Controls

§134 Lighting Control Acceptance...continued	
2005	2008
<ul style="list-style-type: none">• automatic daylighting controls meet [T24]	<ul style="list-style-type: none">• when multi-level astronomical time switch used to meet EXCEPTION 3 to § 131(c)• all general lighting in skylit area controlled by multi-level astronomical time switch• has an override switch meeting § 131



§ 134 Indoor Lighting Controls

§134 Lighting Control Acceptance...continued	
2005	2008
• automatic lighting controls meet applicable requirements [T24]	
• occupant-sensors meet the applicable requirements [T24]	
	• outdoor lighting controls meet the applicable requirements [T24]



Questions ?



CALIFORNIA ENERGY COMMISSION

Nonresidential Indoor Lighting Requirements



Nonresidential Indoor Lighting §146

Calculation of Actual Indoor Lighting Power Density - §146(a)	
2005	2008
<ul style="list-style-type: none">Includes total watts of all planned permanent and planned portable lighting systems (for all applications)	
<ul style="list-style-type: none">Offices ≥ 250 ft² minimum 0.2 W/ft² assumed portable lightingMust subtract 0.2 from general lighting allowance	<ul style="list-style-type: none">EXCEPTION: ≤ 0.2 W/ft² portable lighting for all office areas not added to LPD0.2 Not subtracted from general lighting allowance
<ul style="list-style-type: none">Supplemental portable lighting compliance form required	<ul style="list-style-type: none">Supplemental portable lighting compliance form deleted



Nonresidential Indoor Lighting §146

When interlocked lighting systems serve a space	
2005	2008
<ul style="list-style-type: none">• For any space	<ul style="list-style-type: none">• Only for auditorium, convention center, conference room, multipurpose room, or theater...
<ul style="list-style-type: none">• Use highest wattage system if interlocked to prevent simultaneous operation	
	<ul style="list-style-type: none">• Interlocked with a non-programmable double throw switch
<ul style="list-style-type: none">• Or, preset dimming under the direct control of authorized personnel.	<ul style="list-style-type: none">• Preset dimming option no longer available.



Nonresidential Indoor Lighting §146

PAF - Multi-Level Occupancy Sensor

2005	2008
<ul style="list-style-type: none">• Control complies with §119• $\geq 50\%$ light output within applicable space listed in TABLE• Only one PAF used for luminaire (Except as noted in Table)	
<ul style="list-style-type: none">• Small offices $\leq 250 \text{ ft}^2$	<ul style="list-style-type: none">• Any space $\leq 250 \text{ ft}^2$ enclosed by floor-to-ceiling partitions
<ul style="list-style-type: none">• Any size classroom, corridor, conference or waiting room	
<i>(continued on next slide)</i>	



Nonresidential Indoor Lighting §146

PAF- Multi-Level Occupancy Sensor shall

2005	2008
<ul style="list-style-type: none">• Meet uniformity requirements § 131(b)	
<ul style="list-style-type: none">• 1st stage activate 50-70% of lighting power	<ul style="list-style-type: none">• 1st stage activate 30-70% of lighting power
<ul style="list-style-type: none">• Either automatic or manual action	<ul style="list-style-type: none">• Either automatic or manual action, switching or dimming
<ul style="list-style-type: none">• After that event, manually<ul style="list-style-type: none">i Activating the alternate set of lights.ii Activating 100% of the lighting power.iii Deactivating all lights.	



Nonresidential Indoor Lighting §146

Relative System Efficiency for Dimming Ballasts	
2005	2008
	<ul style="list-style-type: none">• To qualify for PAF:• RSE required for dimmable electronic ballasts• Which are T5 and T8 fluorescent lighting systems
	<ul style="list-style-type: none">• $RSE = \text{Ballast Factor} / (\text{Ballast Input Power} / \text{Total Rated Lamp Power})$• Where Total Rated Lamp Power = number of Lamps per Ballast x Rated Lamp Power



Nonresidential Indoor Lighting §146

Relative System Efficiency Table for Dimming Ballasts

	Required RSE			Corresponding BEF			
Lamp Category	1 or 2 lamps			1 x 28W lamp	2 x 28W lamps	1 x 54W HO lamps	2 x 54W HO lamps
T5	0.85			3.03	1.51	1.57	0.78
	1 lamp	2 or 3 lamps	4 lamps	1 x 32W lamp	2 x 32W lamps	3 x 32 W lamps	4 x 32W lamps
T8	0.86	0.90	0.98	2.69	1.4	0.93	0.76



Nonresidential Indoor Lighting §146

Relative System Efficiency Table for Dimming Ballasts

To calculate corresponding BEFs for lamp wattages and number of lamps not shown in table, use the following formula:

$$BEF = \left(\frac{RSE \times 100}{\# \text{ lamps} \times \text{lamp watts}} \right)$$

$$RSE = \left(\frac{BallastFactor}{\text{Ballast Input Power} / \text{Total Rated Lamp Power}} \right)$$

Note: Where Total Rated Lamp Power = number of Lamps per Ballast x Rated Lamp Power.



Nonresidential Indoor Lighting §146

Table 146-A Lighting Power Adjustment Factors

2005	2008
<ul style="list-style-type: none">• Inconsistent language between §146(a)4 and Table 146-A	<ul style="list-style-type: none">• Table 146-A edited for clarity• Changes to PAF factors for demand responsive dimmable ballasts• RSE required for dimmable ballasts• PAF for Daylighting controls rewritten



Nonresidential Indoor Lighting §146 - PAF Table

TYPE OF CONTROL	TYPE OF SPACE	FACTOR
<ul style="list-style-type: none">• Demand responsive lighting control	All building types	0.05
<ul style="list-style-type: none">• Manual dimming of dimmable electronic ballasts		0.10
<ul style="list-style-type: none">• Demand responsive lighting control• combination with manual dimming of dimmable electronic ballasts		0.15



Nonresidential Indoor Lighting §146

2005	2008
<ul style="list-style-type: none">• Lighting Wattage Excluded from actual LPD	<ul style="list-style-type: none">• Lighting applications excluded from Section 146(b)



Nonresidential Indoor Lighting §146

Lighting applications excluded from Section 146(b)	
2005	2008
<ul style="list-style-type: none">• Lighting for film, video or photography studios	<ul style="list-style-type: none">• Lighting for film or photography studios provided systems separately switched from general lighting system
	<ul style="list-style-type: none">• Videoconferencing studio• Up to 2.5 W/ft² provided:<ul style="list-style-type: none">✓ VC lighting addition to & separately switched from general lighting✓ all lighting controlled by a multiscene programmable control system✓ Permanently installed VC cameras, audio equipment, and playback equipment



Nonresidential Indoor Lighting §146

Lighting applications excluded from Section 146(b)	
2005	2008
<ul style="list-style-type: none">• Medical and clinical buildings..	<ul style="list-style-type: none">• ...provided lighting systems additions to and separately switched from general lighting system
<ul style="list-style-type: none">• Plant growth or maintenance	<ul style="list-style-type: none">• ...if controlled by a multi-level astronomical time-switch complying §119(h)
	<ul style="list-style-type: none">• Theatrical lighting used for religious worship
	<ul style="list-style-type: none">• ATM lighting located inside parking garages.



Nonresidential Indoor Lighting §146

(b) Indoor Lighting Power Trade-offs

- LPD shall not be traded between Complete Building, Area Category, or Tailored Methods
 - EXCEPTION: LPD may be traded from Area Category to Tailored Method.
- NO trading LPD between indoor and outdoor areas
- Complete Building Method LPD traded only within a single building
 - Conditioned and unconditioned spaces separate allotments



Nonresidential Indoor Lighting §146

(b) Indoor Lighting Power Trade-offs

- Area Category Method LPD traded between areas using Area Category Method
 - No trade-off between conditioned and unconditioned spaces
 - Additional ornamental/task LPD from notes bottom of Area Table shall not be traded
- Tailored LPD - no trade-off wall display, floor display and ornamental/special effects lighting
 - General illumination LPD traded only within areas using Tailored Method



Nonresidential Indoor Lighting §146

Complete Building Method

- Added: may be used for tenant space where one type of use makes up 90 percent of the space
- Retail and wholesale stores, hotel/motel, and high-rise residential buildings shall not use this method.
- May be used for combined building where there is a Parking Garage + another complete building category
 - Parking garage portion and remaining portion shall each separately qualify for and use categories from Table



Nonresidential Indoor Lighting §146

Complete Building Method Table

Changes To COMPLETE BUILDING METHOD LIGHTING POWER ALLOWANCES		
TYPE OF USE	ALLOWED LPD	
	2005	2008
Classroom Building	NA	1.1
Convention centers	1.3	1.2
General commercial and industrial work buildings - High bay	1.1	1.0
Hotel	1.4	NA
Industrial and commercial storage buildings	0.7	0.6
Library	NA	1.3
Office buildings	1.1	0.85
Parking Garages	0.4	0.3
Retail and wholesale stores	1.5	NA
Schools	1.2	1.0



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**Changes To
TABLE 146-F AREA CATEGORY METHOD - LPD**

PRIMARY FUNCTION		ALLOWED LIGHTING POWER (W/ft ²)	
		2005	2008
Auto Repair		1.1	0.9
Commercial and industrial storage		0.6	0.6
Commercial and industrial storage (refrigerated)		NA	0.7
Electrical, mechanical, telephone rooms		0.7	0.7
General commercial and industrial work	Low bay	1.1	1.0
	High bay	1.0	.09
	Precision	1.3	1.2
Housing, Public and Commons Areas	Multi-family, Dormitory	1.0	1.0
	Dormitory , Senior Housing	1.5	1.5
Laboratory, Scientific		NA	1.4
Offices	> 250 square feet	1.2	0.9
	≤ 250 square feet	NA	1.1
Parking garage	Parking Area	0.4	0.2
	Ramps and Entries	NA	0.6
Retail merchandise sales, wholesale showrooms		1.7	1.6



Nonresidential Indoor Lighting §146

Tailored Method

- Displays installed against a wall shall not qualify for the floor display lighting power allowances.
- Floor displays shall not qualify for the wall display allowances.
- Permanent full height partitions shall extend from the floor to within 2 feet of the ceiling or are taller than 10 feet, and are permanently anchored to the floor.
 - Commercial and industrial storage stacks are not classified as permanent full height partitions.



Nonresidential Indoor Lighting §146

Tailored Method

- Qualifying wall lighting systems shall be mounted within ~~six~~ **ten** feet of wall
- Qualifying floor display lighting systems shall be mounted no closer than ~~six~~ **two** feet to a wall and
- In retail merchandise sales, museum, and religious worship, the lighting power for very valuable displays cases
 - Removed from Tailored Method table and inserted into textSmallest of:
 - Area of space times 1.0 W/ft², or
 - Area display case times 16 W/ft², or
 - Actual power



Nonresidential Indoor Lighting §146

Tailored Method

Primary Function Name Changes	
2005	2008
Classrooms, lecture, training, vocational room	Education facilities: Classrooms, lecture, training, vocational room; Science Labs
Corridors, restrooms, stairs and support areas	Stairways and corridors; toilets and washrooms
Jail	Correction Facility cells and day rooms
Kitchen, food preparation	Food Service Facilities: Butcher Shop, Food Display, Galley, Kitchen, Scullery; All other
All other	All other only if not included above



Nonresidential Indoor Lighting §146

Tailored Method

Primary Function	Illumination Category		Wall Display Power (W/ft)	
	2005	2008	2005	2008
Correction Facility cells and day rooms	IESNA HB	D	0	0
Dressing room	NA	D	0	0
Education facilities Classrooms, lecture, training, vocational room Science Labs	D NA	D E	7.0 NA	5.5 5.5
Food Service Facilities Butcher Shop, Food Display, Galley, Kitchen, Scullery All other	IESNA HB NA	E C	0 0	0 0
Public rest areas along state and federal roadways	NA	IESNA HB	0	0
Stairways and corridors; toilets and washrooms	IESNA HB	B	0	0



Nonresidential Indoor Lighting §146

Tailored Method

Primary Function	Illumination Category	
	2005	2008
Commercial and industrial storage Inactive Active: bulky items; large labels Active: small items; small labels	IESNA HB NA NA NA	B C D
Laundry	IESNA HB	D
Locker/dressing room 1	IESNA HB	C
Office Open office; Intensive VDT use Open office; Intermittent VDT use Private Office	IESNA HB NA NA NA	D E E



Nonresidential Indoor Lighting §146

Tailored Method

Primary Function	Wall Display Power (W/ft)	
	2005	2008
Auditorium	2.5	2.25
Civic Meeting Place	3.5	3.15
Financial Transactions	3.5	3.15
Hotel function area	2.5	2.25



Nonresidential Indoor Lighting §146

Tailored Method

Primary Function	Wall Display Power (W/ft)		Allowed Floor Display Power (W/ft ²)	
	2005	2008	2005	2008
Grocery store	11	9.9	1.2	1.1
Retail merchandise sales, wholesale showrooms	21	17.0	1.5	1.2



Nonresidential Indoor Lighting §146

Tailored Method

Primary Function	Allowed Ornamental/ Special Effect Lighting	
	2005	2008
Housing, Public and Commons Areas		
Multi-family	1.0	0.9
Dormitory, Senior Housing	1.0	0.9
Library (Reading areas, Stacks)	0.7	0.6
Malls and atria	0.7	0.6



Nonresidential Indoor Lighting §146

Tailored Method

Primary Function	Wall Display Power (W/ft)		Allowed Ornamental/ Special Effect Lighting	
	2005	2008	2005	2008
Lobbies:				
Hotel lobby	3.5	3.15	0.7	0.6
Main entry lobby	3.5	3.15	0	0
Transportation Function	3.5	3.15	0.7	0.6
Waiting area	3.5	3.15	0.7	0.6



Nonresidential Indoor Lighting §146

Tailored Method

TABLE 146-H ADJUSTMENTS FOR MOUNTING HEIGHT ABOVE FLOOR

Height in feet above finished floor and bottom of luminaires	Floor Display - Multiply by	Wall Display – Multiply by
11' 6" or less	1.0	1.0
>11' 6"	1.2	1.15
>16'	1.4	1.35
> 20'	2.0	1.75



Alterations – Prescriptive Approach § 149

Existing Nonresidential indoor lighting systems § 149(b)(H)

2005	2008
<ul style="list-style-type: none">Altered lighting, and newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110 through 139	<i>See changes on next slide</i>
<ul style="list-style-type: none">Alterations that increase connected lighting load or replace $\geq 50\%$ luminaires shall meet T24	



Alterations – Prescriptive Approach § 149

Existing Nonresidential indoor lighting systems § 149(b)(H)

2005	2008
	<ul style="list-style-type: none">Alterations that increase lighting load, replace, or remove and re-install $\geq 50\%$ luminaires in enclosed space
	<ul style="list-style-type: none">Where new or moved wiring is being installed to serve added or moved luminaries; orWhere conductor wiring from the panel or from a light switch to the luminaires is being replaced, orWhere a lighting panel is installed or moved.
	<ul style="list-style-type: none">Where an existing enclosed space is subdivided into two or more spaces
	<ul style="list-style-type: none">Alterations that increase existing LPD > 0.5 W/ft²

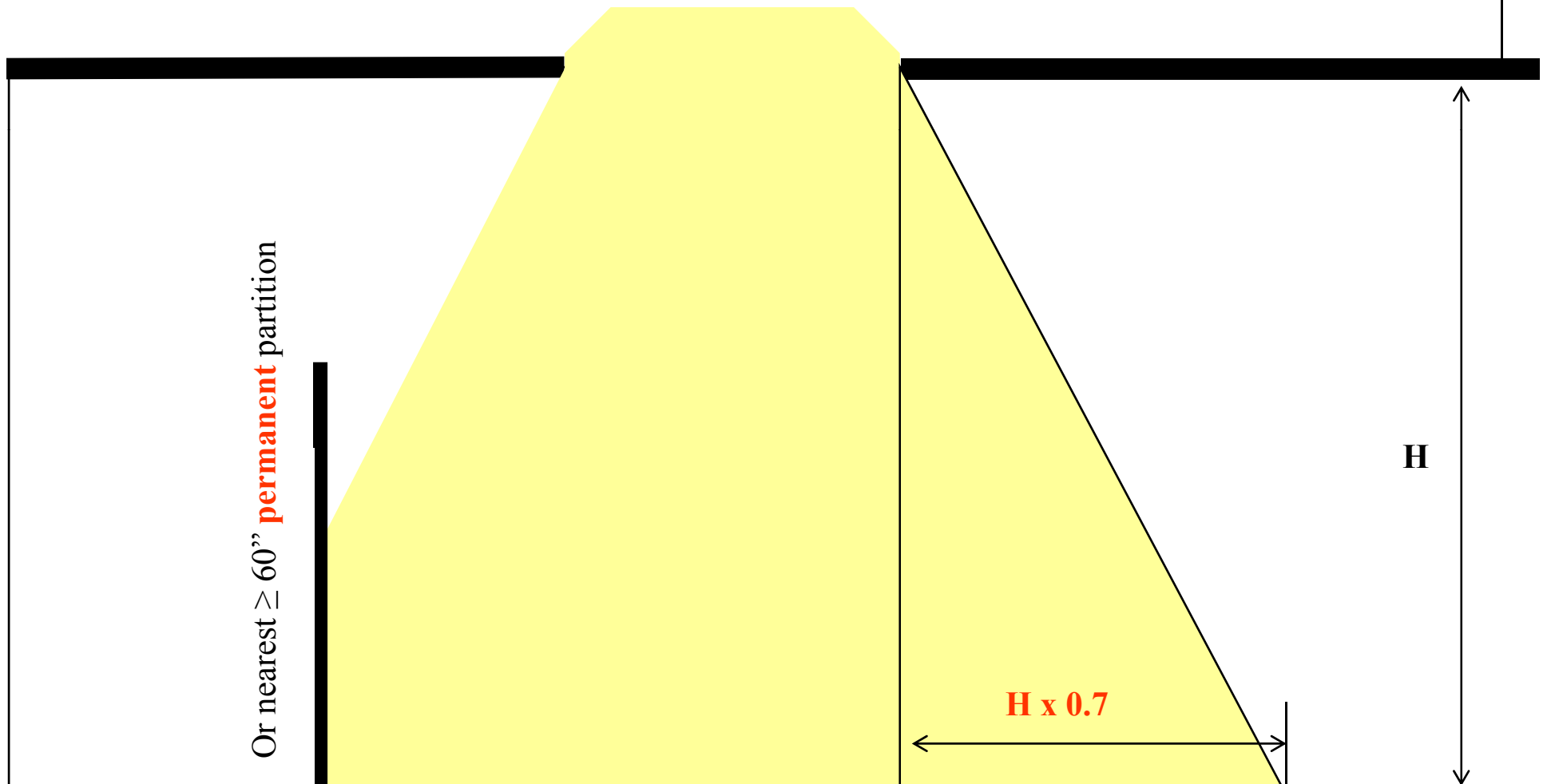


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Nonresidential Daylighting

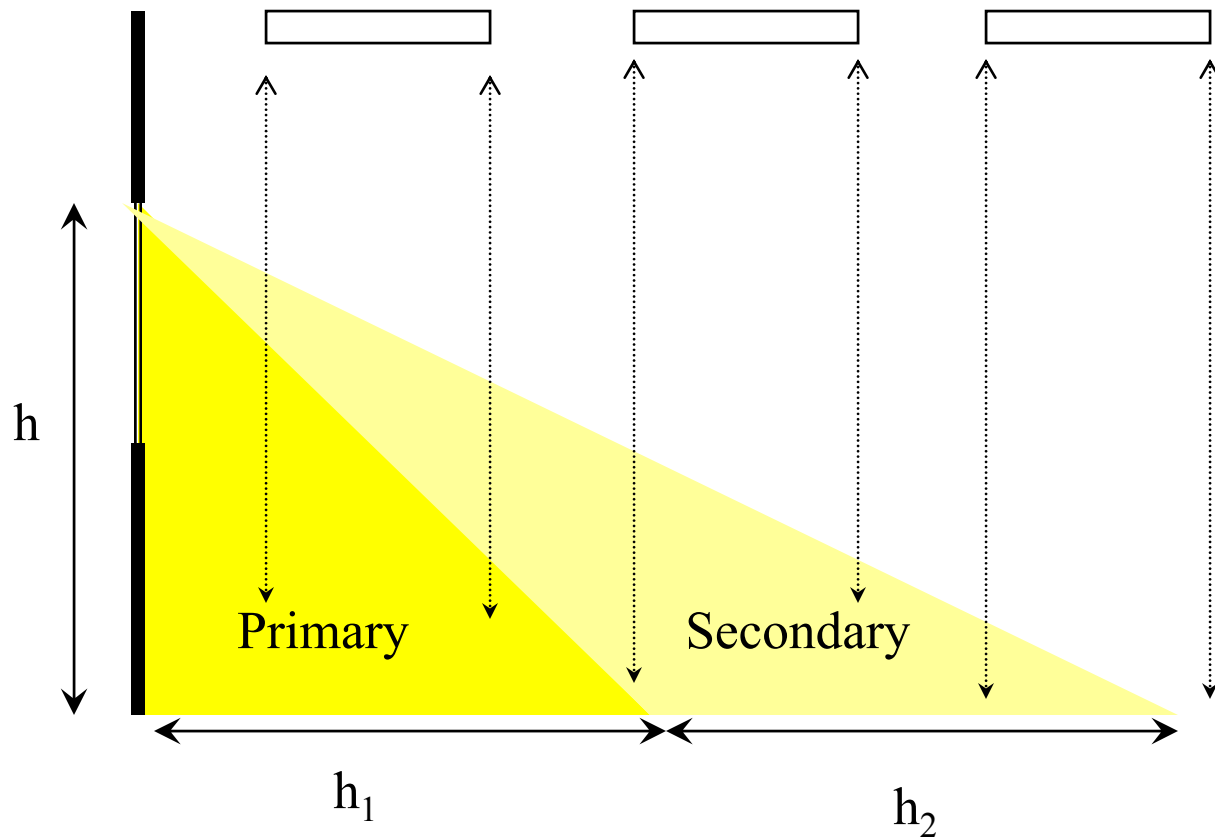


No Changes to Definition of Skylight Area





New Definitions Primary and Secondary Sidelit Area





§ 131(c) Indoor Lighting Controls

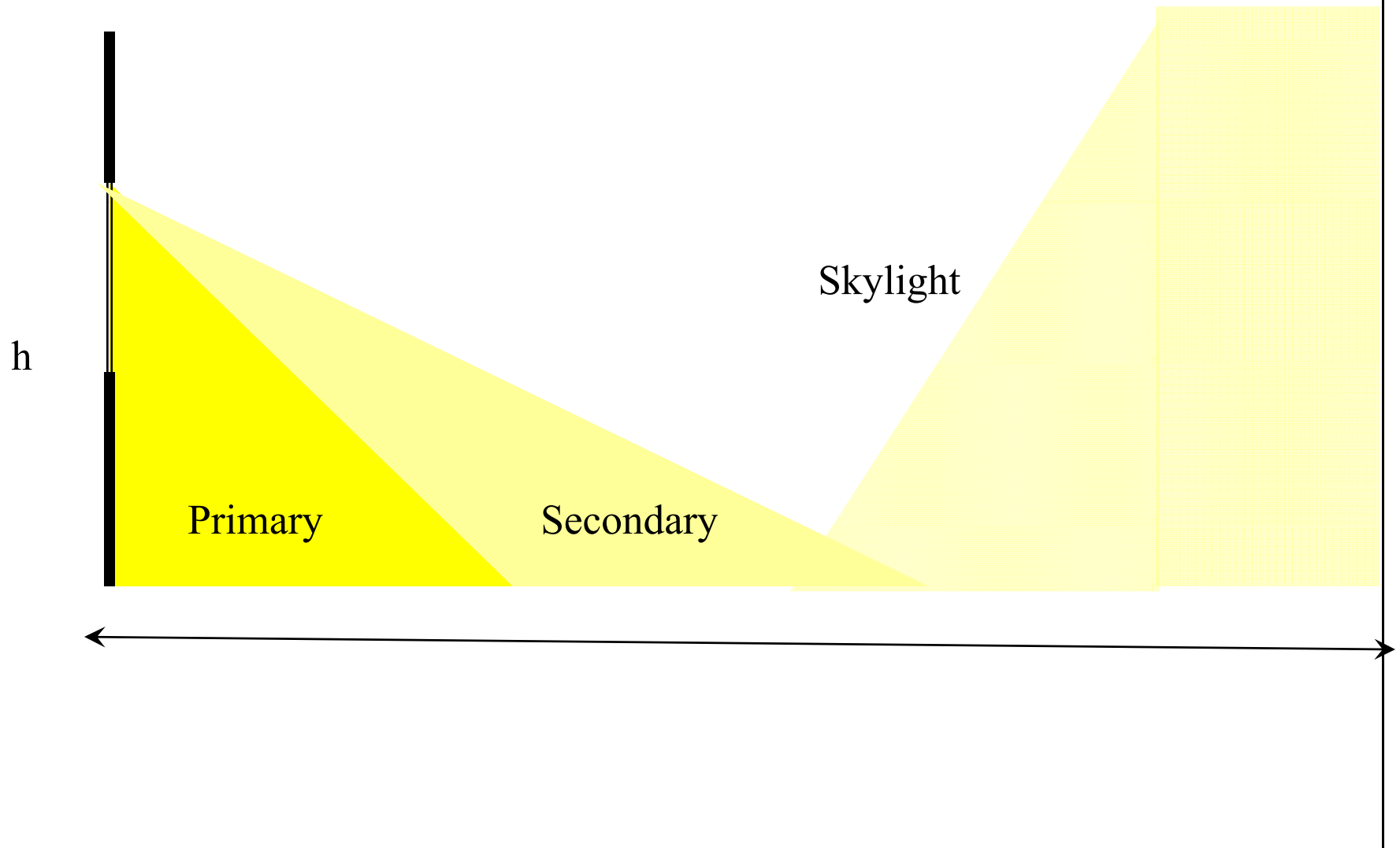
1. Daylighting Areas

No double counting overlapping areas

- Primary Sidelit
- Secondary Sidelit
- Skylit



No double counting overlapping daylit areas





§ 131(c) Indoor Lighting Controls

Daylighting Controls

Primary sidelit and skylit areas – shall have at least one control

- Separately controls $\geq 50\%$ general lighting power in primary sidelit and skylit areas
- Primary sidelit areas controlled separately from skylit areas

EXCEPTION:

- Primary sidelit and skylit combined area $\leq 250 \text{ ft}^2$ in an enclosed space



§ 131(c) Indoor Lighting Controls

Daylighting Controls

Skylit Daylight Areas

- Skylit daylight areas shall be shown on plans
- Automatic daylighting control device certified to meet applicable requirements of §119
- Installed in accordance with §131(c)2D (explained on following slide)

Continued...



Daylighting Controls

Skylit Daylight Areas

Auto daylight control shall be installed as follows:

- Photosensor located so not readily accessible
- Calibration accessible
 - Only to authorized personnel or
 - Located < 2 feet of ceiling access panel that is ≤ 11 feet above floor
- Shall be multi level – one step between 50-70% rated power

Exceptions

- $LPD < 0.3 \text{ W/ft}^2$
- Replaced skylights
- Added skylights in existing building with existing general lighting system
- Controlled lighting + daylighting shall never be $<$ than controlled lighting when no daylight available
- Power consumption shall be $\leq 35\%$ when illuminance levels 150%



Exceptions to Skylit Daylight Area Controls

When:

- Total skylit daylight $\leq 2,500 \text{ ft}^2$ in enclosed space
- Skylights were existing adjacent structure obstructs direct beam sunlight ≥ 6 hrs/day during equinox calculated using computer or graphical methods
- Skylight meeting all of the following conditions:
 - Effective aperture $> 4.0 \%$, and
 - General lighting skylit area controlled by a multi-level astronomical time switch meeting §119, and
 - Has override switch meeting §131(d)2 (same as override for shutoff controls)
- Skylights where the EA < 0.006 as specified in §146(a)2E



§ 131(c) Indoor Lighting Controls

Daylighting Controls

Primary Sidelite Daylight Areas

- Primary sidelite daylight areas shall be shown on plans
- General lighting in area controlled independently by...
- Automatic daylighting control device for general lighting
§119 compliant

Continued....



Daylighting Controls

Primary Sidelit Daylight Areas

Auto daylight control shall be installed as follows:

- Photosensor located so not readily accessible
- Calibration accessible
 - Only to authorized personnel or
 - Located < 2 feet of ceiling access panel that is ≤ 11 feet above floor
- Shall be multi level – one step between 50-70% rated power

Exceptions

- $LPD < 0.3 \text{ W/ft}^2$
- Replaced skylights
- Added skylights in existing building with existing general lighting system
- Controlled lighting + daylighting shall never be $<$ than controlled lighting when no daylight available
- Power consumption shall be $\leq 35\%$ when illuminance levels 150%



§ 131(c) Indoor Lighting Controls

Daylighting Controls

Primary Sidelit Daylight Areas

EXCEPTIONS to Required Daylighting Controls

- Total primary sidelite daylight $\leq 2,500 \text{ ft}^2$ in enclosed space
- Where the EA < 0.6 as specified in §146(a)2E
- Where existing adjacent structures 2 X as tall as distance from windows
- Parking garages



SKYLIGHT Daylighting §143(c)

Minimum Skylight Area for Large Enclosed Spaces in Buildings – Type of Buildings Affected	
2005	2008
<ul style="list-style-type: none">• Low Rise Buildings	<ul style="list-style-type: none">• Buildings ≤ 3 stories
<ul style="list-style-type: none">• Climate zones 2 through 15• Low rise conditioned or unconditioned enclosed spaces• Directly under roof• Ceiling heights > 15 ft• LPD for general lighting ≥ 0.5 W/ft²	
<ul style="list-style-type: none">• $> 25,000$ ft²	<ul style="list-style-type: none">• $> 8,000$ ft²



SKYLIGHT Daylighting §143(c)

Minimum Skylight Area for Large Enclosed Spaces in Buildings – Type of Buildings Affected

2005	2008
	<ul style="list-style-type: none">• S-1 and S-2 (storage) occupancies, and• F-1 and F-2 (factory) occupancies, and• With heights > 15 feet<ul style="list-style-type: none">✓ Shall be deemed to have ceiling heights > 15 feet when ceiling plan not provided, and✓ Shall be deemed to have LPD > 0.5 W/ft² when a completed general lighting plan for the entire space is not provided



SKYLIGHT Daylighting §143(c)

Minimum Skylight Area for Large Enclosed Spaces in Buildings – Requirements	
2005	2008
<ul style="list-style-type: none">• $\geq \frac{1}{2}$ floor area in skylit area under skylights, and• Skylit area shall be shown on the building plans• Have a glazing material or diffuser measured haze value $> 90\%$,• Conditioned space shall meet § 143(a)6 or 143(b)• Electric lighting controlled per § 131 (c) 2	
<ul style="list-style-type: none">• Skylit shall have minimum skylight area according to Table 143-F	<ul style="list-style-type: none">• Skylit shall have minimum skylight area to skylit area ratio of at least 3.3% or• Minimum skylight effective aperture of at least 1.1%



SKYLIGHT Daylighting §143(c)

Minimum Skylight Area for Large Enclosed Spaces in Buildings – Subsections Referenced in §143(c)

2005	2008
<p>§ 143(a)6 Skylights shall:</p> <ul style="list-style-type: none">• $\leq 5\%$ gross exterior roof area (Atria > 55 feet $\leq 10\%$); and• U-factor \leq TABLE 143-A, B, or C; and• SHGC \leq TABLE 143-A, B, or C. <p>§ 143(b)</p> <ul style="list-style-type: none">• Total TDV Energy overall envelope of proposed building \leq total TDV Energy of the overall envelope of a standard building	



SKYLIGHT Daylighting §143(c)

Minimum Skylight Area for Large Enclosed Spaces in Buildings – Subsections Referenced in §143(c)

2005

2008

Electric lighting controlled per § 131(c)2

- Skylit daylight area shown on plans.
- Controlled independently by an automatic daylighting control device
- Photosensors ceiling mounted or accessible only to authorized personnel, and located to maintain adequate illumination in the area in accordance with the designer's or manufacturer's instructions.
- Location where calibration made readily accessible to authorized personnel, or located ≤ 2 feet of ceiling access panel ≤ 11 feet above floor level.
- Multi-level, including continuous dimming, and one step 50% to 70% of design power



SKYLIGHT Daylighting §143(c)

Minimum Skylight Area for Large Enclosed Spaces in Buildings – Exceptions to §143(c)	
2005	2008
• EXCEPTION to §143(c): Auditoriums, movie theaters, museums, and refrigerated warehouses.	
	• ADDED EXCEPTIONS: Churches, permanent structure above roof



Alterations – Skylights §149(b)

Adding skylights to existing buildings:

- When § 131(c)2 triggered by addition of skylights to existing building
- And lighting system is not re-circuited
- Daylighting control need not meet multi-level requirements in Section 131(c)2A.



SKYLIT AND SIDELIT Daylighting §146

PAF - For automatic daylighting control	
2005	2008
	<ul style="list-style-type: none">• Certified to § 119• Installed according to § 131• ≥ 50 % luminaire in daylit area• Daylight area shown on the building plans• PAF not available for controls required by §131(c)
<ul style="list-style-type: none">• Sidelit Area• Skylit Area	<ul style="list-style-type: none">• Primary Sidelit Area• Secondary Sidelit Area• Skylit Area



SKYLIGHT Daylighting §146

PAF Table for Automatic Multi-level Daylighting Controls

- Total skylit daylight areas in enclosed space < 2,500 square feet, and where glazing material or diffuser has ASTM D1003 haze measurement > 90%

Effective Aperture	$0.6\% \leq EA < 1\%$	$1\% \leq EA < 1.4\%$	$1.4\% \leq EA < 1.8\%$	$1.8\% \leq EA$
$LPD < 0.7$	0.24	0.30	0.32	0.34
$0.7 \leq LPD < 1.0$	0.18	0.26	0.30	0.32
$1.0 \leq LPD < 1.4$	0.12	0.22	0.26	0.28
$1.4 \leq LPD$	0.08	0.20	0.24	0.28



SKYLIGHT Daylighting §146

PAF - Automatic daylighting control credit

Skylit Daylit Area

2008

- PAF skylit areas.

$$\text{Skylit Effective Aperture} = \frac{0.85 \times \sum \text{Skylight Area} \times VT \times \text{Well Efficiency}}{\text{Skylit Daylight Area}}$$



SKYLIGHT Daylighting §146

PAF - Automatic daylighting control credit

Skylit Daylit Area

2008

- Well Efficiency from
Equation 146 F, or
Table 146B for specular and tubular light wells
Table 146-A for other wells

Equation 146 F

$$WE_{Tube} = \rho \left(2.2 * \frac{L}{D} \right)$$



SIDELIT (Window) Daylighting §146

PAF Table for Automatic Multi-level Daylighting Controls

Available only when:

- Total primary sidelit daylight areas $< 2,500 \text{ ft}^2$ in an enclosed space, and
- All secondary sidelit areas

Effective Aperture	$>10\%$ and $\leq 20\%$	$>20\%$ and $\leq 35\%$	$>35\%$ and $\leq 65\%$	$> 65\%$
FACTOR	0.12	0.20	0.25	0.30



Daylighting §146

PAF - Automatic daylighting control credit

2008

Primary Sidelit Area

$$\text{Primary Sidelit Effective Aperture} = \frac{\sum \text{Window Area} \times VT}{\text{Primary Sidelit Daylight Area}}$$

Secondary Sidelit Area

$$\text{Secondary Sidelit Effective Aperture} = \frac{\sum \text{Window Area} \times VT}{\text{Secondary Sidelit Daylight Area} + \text{Primary Sidelit Daylight Area}}$$



SIDELIT Daylighting §146

PAF - Automatic daylighting control credit

2008

Primary Sidelit Area

- Used only if the daylighting separately controlled lighting in **primary** sidelit daylight area.

Secondary Sidelit Area

- Used if the daylighting separately controlled in **secondary** sidelit area, or
- Used if primary sidelit area + secondary sidelit areas controlled together



Questions ?



CALIFORNIA ENERGY COMMISSION

Nonresidential Outdoor Lighting



Four Outdoor Lighting Zones

- The Energy Commission sets statewide default Lighting Zones
- However, the jurisdictions (usually a city or county), may change the zones to accommodate local conditions.
- Follow a formal public process
- File changes with Energy Commission



Outdoor Lighting Zones

LZ1 Darkest

- Government designated parks, recreation areas, and wildlife preserves

LZ2 Low

- Rural areas, as defined by the most recent US Census

LZ3 Mid

- Urban areas, as defined by the most recent US Census

LZ4 Highest



Go to US Census page to determine
default Lighting Zone

http://factfinder.census.gov/servlet/AdvancedGeoSearchMapFramesetServlet?_lang=en&_command=getPlacenames

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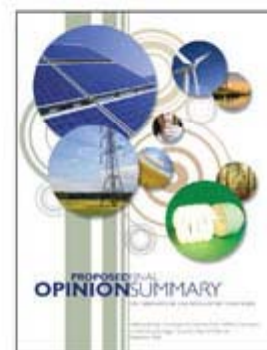
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Proposed Opinion by
CPUC & Energy Commission
on Greenhouse Gas
Emission Regulations

NOW AVAILABLE

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Title 24, Part 6, of the California Code of Regulations

The Energy Efficiency Standards for Residential and Nonresidential Buildings were established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods.

Current Standards



2005 Standards

- Went into effect October 1, 2005, and supersede the 2001 Standards. Projects that apply for a building permit on or after this date must comply with the 2005 Standards.


» [Outdoor Lighting Zones](#)

Adopted Amendments

Cool Roof Coatings Performance Requirements, Effective September 11, 2006.

2008 Standards

Careers @ the Commission

 Careers at the Energy Commission

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September 17, 2008

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[Efficiency Committee Hearing on the Draft Environmental Impact Report](#)



Outdoor Lighting Zones - 2005 Building Energy Efficiency Standards


The Energy Commission adopted changes to the Title 24, Parts 1 and 6, Building Energy Efficiency Standards on November 5, 2003. These new Standards become effective on October 1, 2005. Included in the changes to the Standards are new requirements for outdoor lighting.


 [Outdoor Lighting Zones - General Information](#) (Acrobat PDF file, 6 pages, 140 kilobytes)

 [US Census page, year 2000 geographic map](#)

 [Notice for Local Jurisdictions to Submit Adjustments to Default Outdoor Lighting Zones](#) (Includes Forms) (Acrobat PDF file, 4 pages, 148 kilobytes) Online: September 8, 2004.

You may also download the instructions and form separately below:

 [Instructions and Data Form](#) (Acrobat PDF file, 3 pages, 132 kilobytes)

 [List of Changes to Outdoor Lighting Zones](#) (Updated on February 1, 2006) (Acrobat PDF file, 1 page, 20 kilobytes) Online:

If you have questions about Title 24:

California Energy Commission
Energy Standards Hotline
phone: (916) 654-5106
phone: (800) 772-3300

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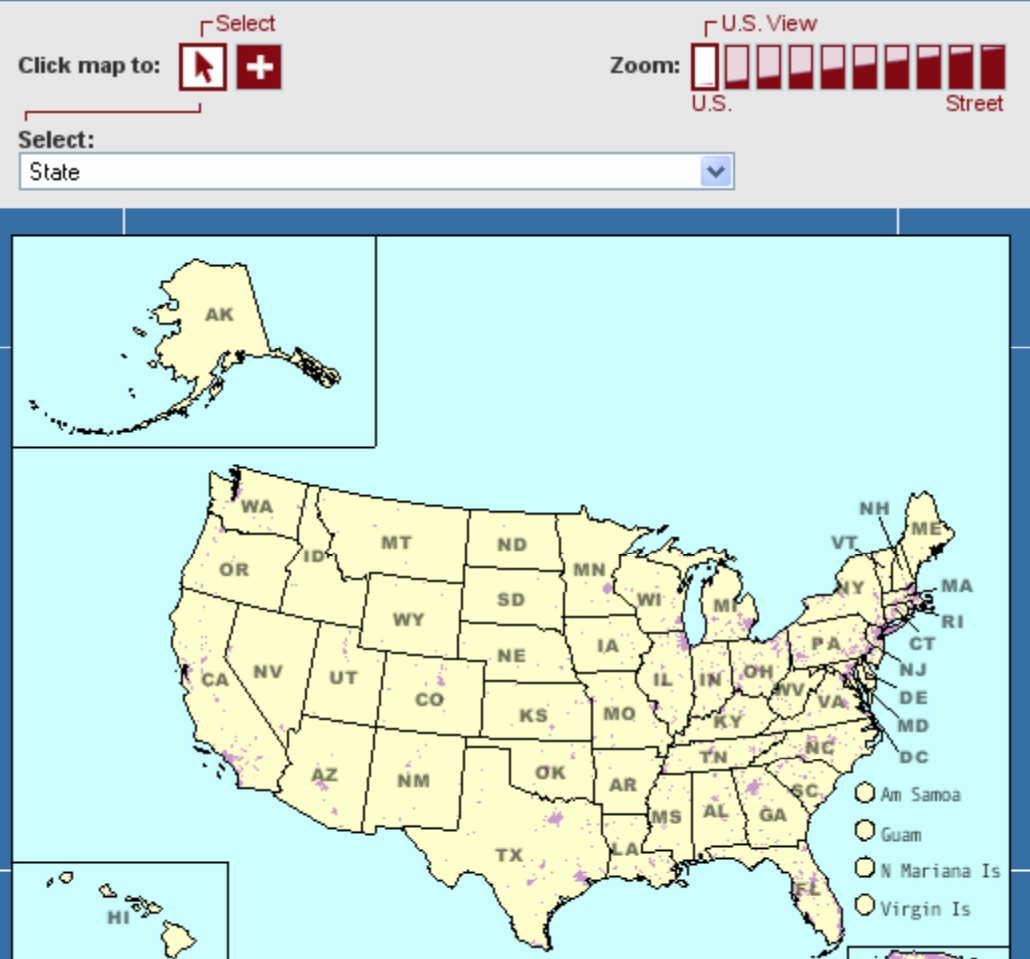
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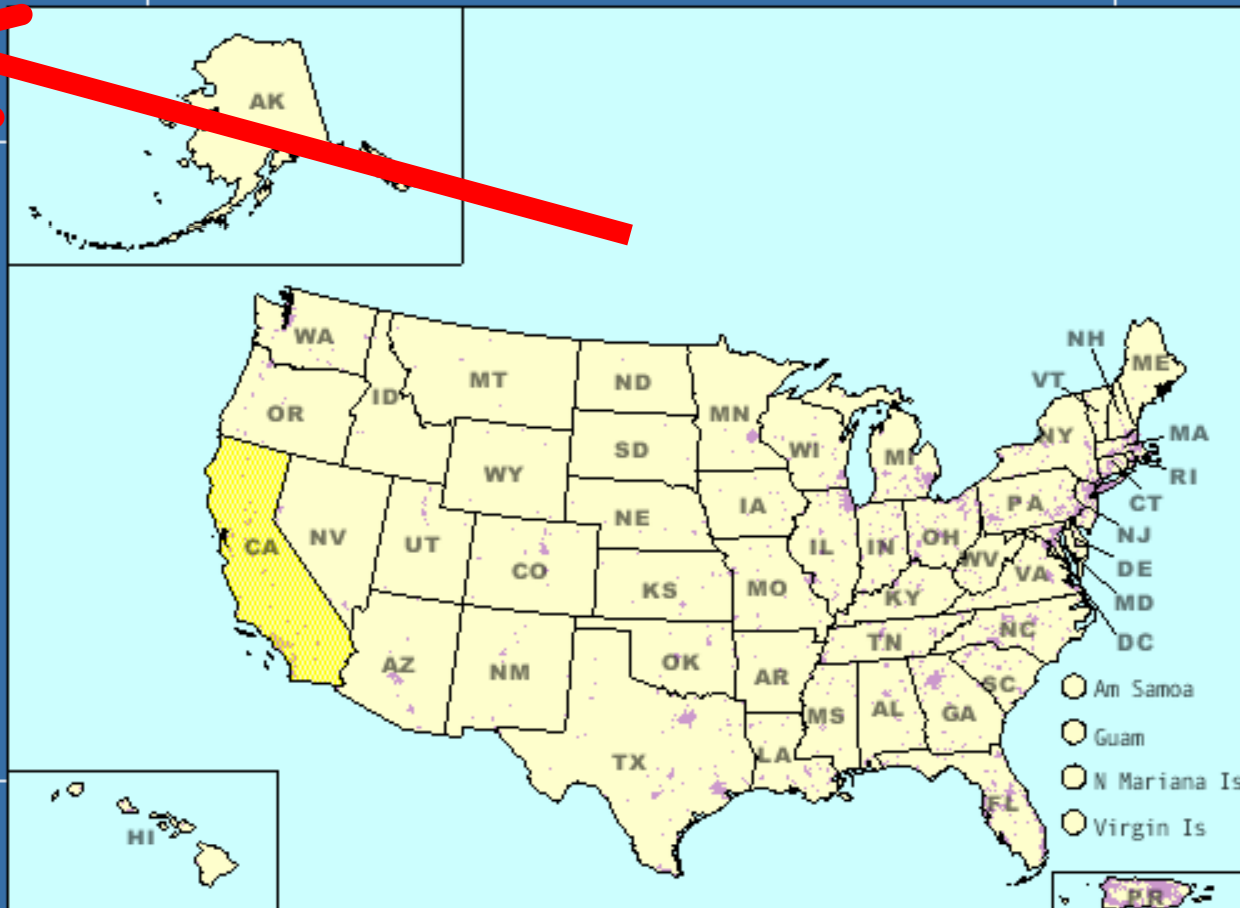
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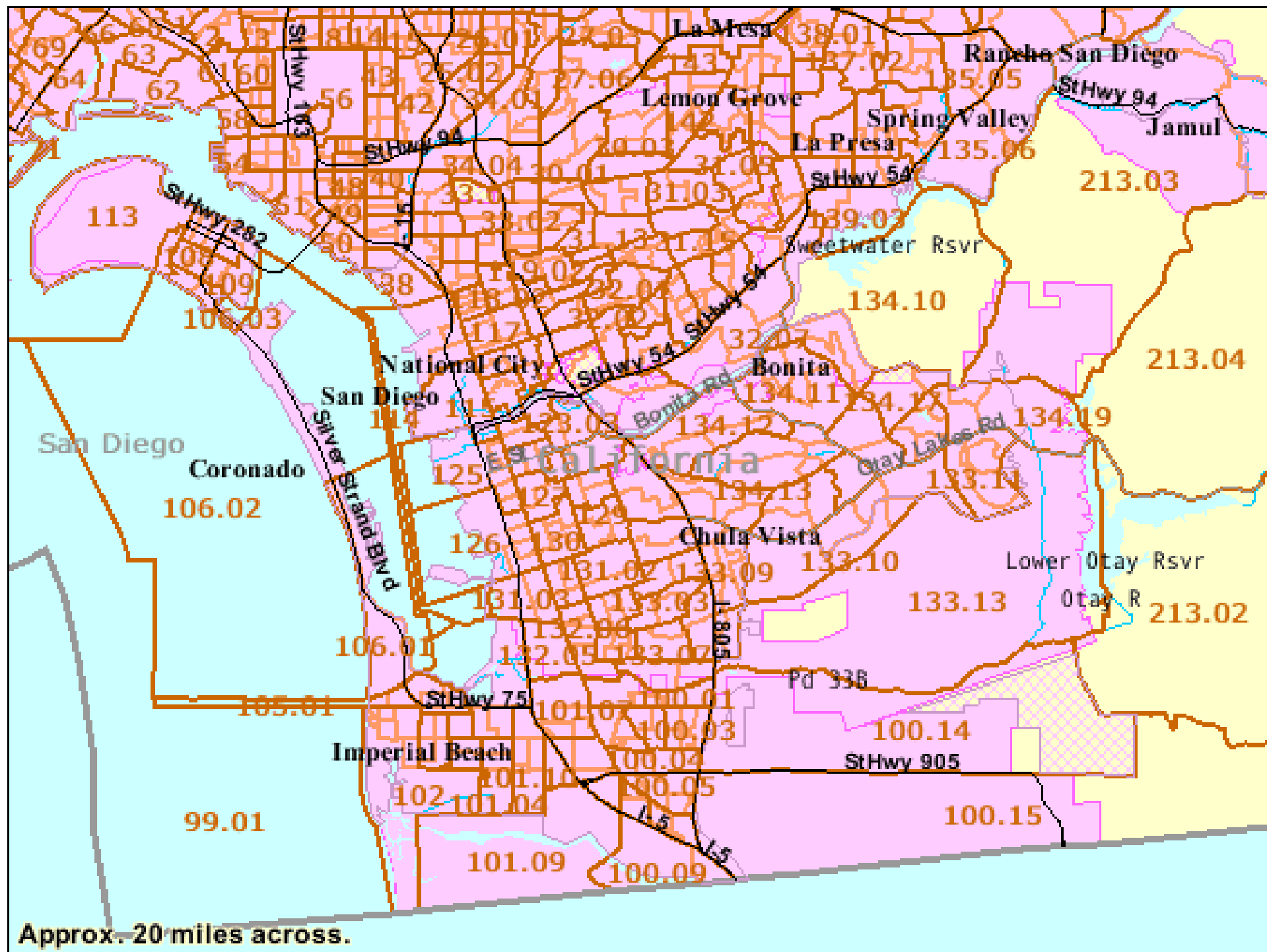
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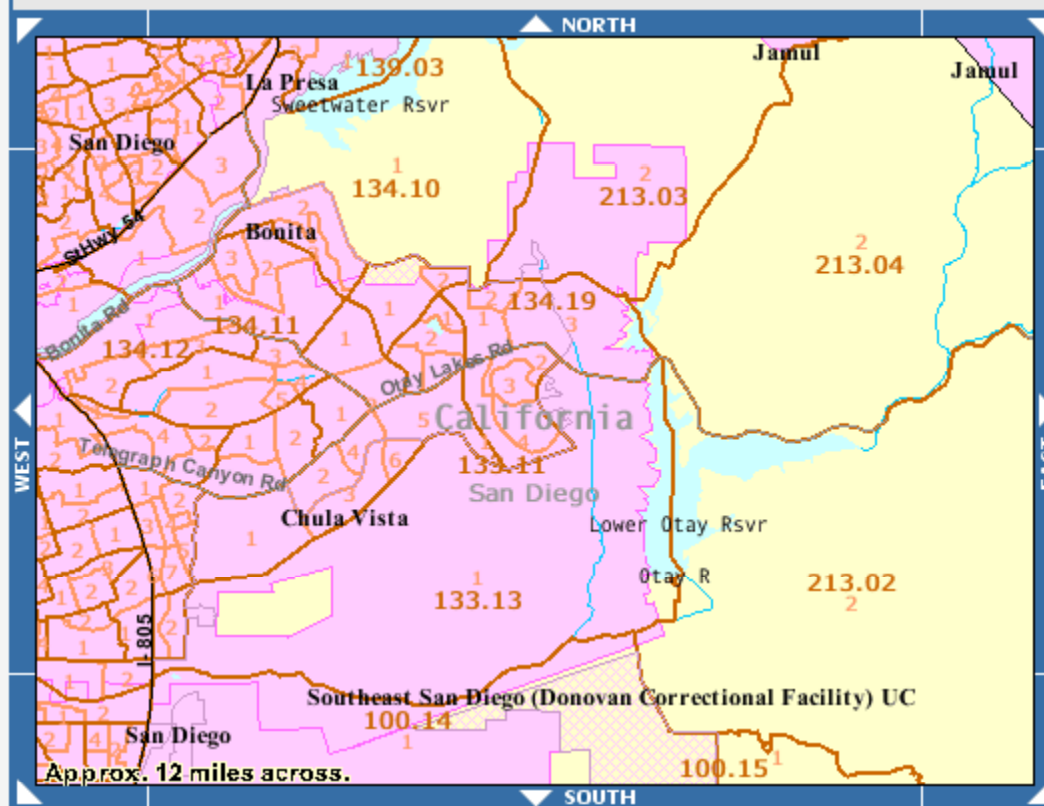
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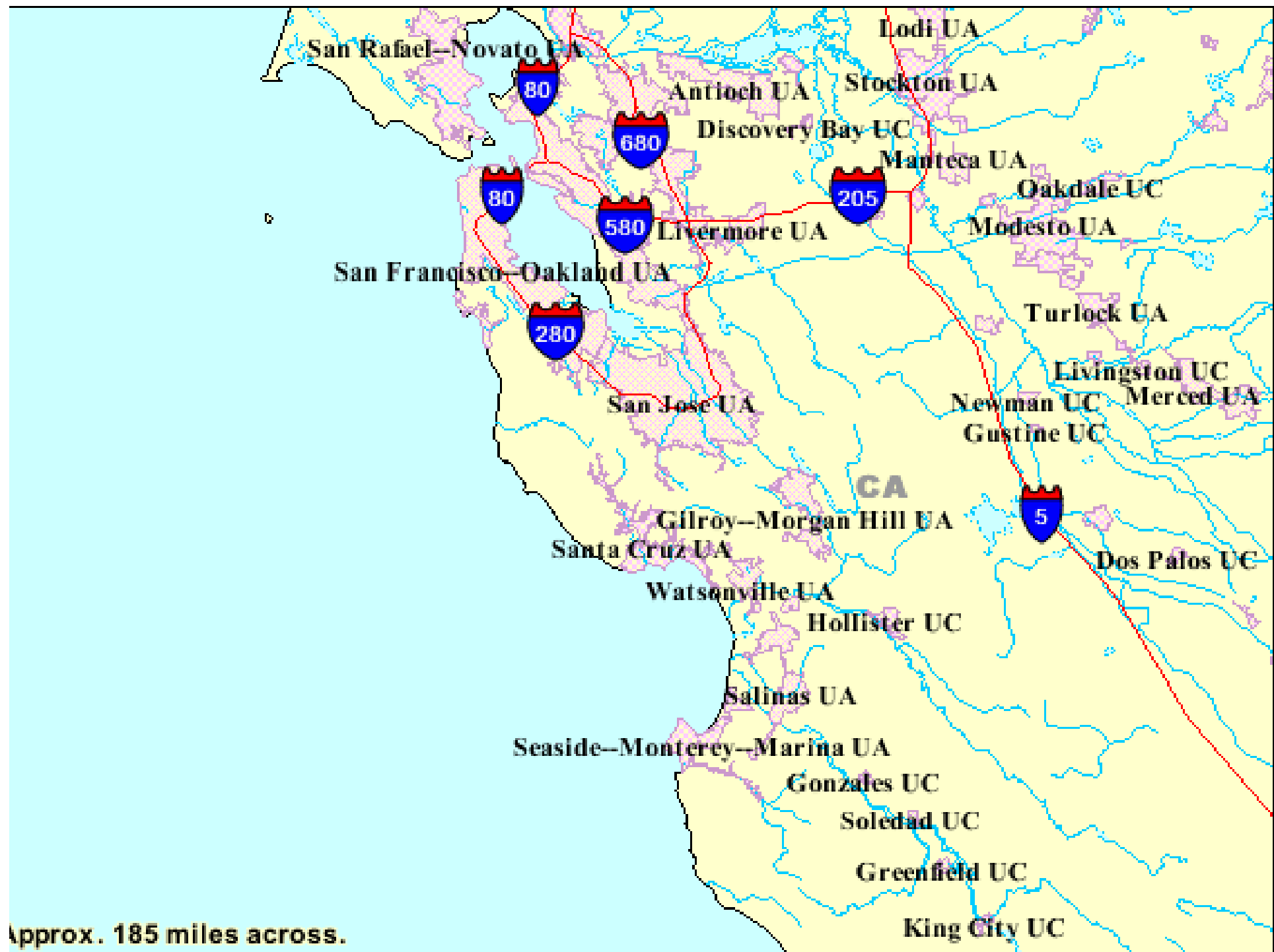
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<input type="checkbox"/>	Division
<input type="checkbox"/>	State
<input type="checkbox"/>	2000 County
<input type="checkbox"/>	2000 County Subdivision
<input type="checkbox"/>	2000 Subbarrio
<input type="checkbox"/>	2000 Census Tract
<input type="checkbox"/>	2000 Block Group
<input type="checkbox"/>	2000 Block
<input type="checkbox"/>	2000 Place
<input type="checkbox"/>	1997 Economic Place*
<input type="checkbox"/>	2000 Consolidated City
<input type="checkbox"/>	2000 American Indian Area/Alaska Native Area
<input type="checkbox"/>	2000 American Indian Off-Reservation Trust Lands/Hawaiian Home Land
<input type="checkbox"/>	2000 Tribal Subdivision
<input type="checkbox"/>	2000 Tribal Census Tract
<input type="checkbox"/>	2000 Tribal Block Group
<input type="checkbox"/>	2000 Alaska Native Regional Corporation
<input type="checkbox"/>	2000 Metropolitan Statistical Area/Consolidated Metropolitan Statistical Area
<input type="checkbox"/>	2000 Primary Metropolitan Statistical Area
<input type="checkbox"/>	2000 Central City of MSA/CMSA
<input type="checkbox"/>	2000 New England County Metropolitan Area
<input type="checkbox"/>	2000 Central City of NECMA
<input checked="" type="checkbox"/>	2000 Urban Area
<input type="checkbox"/>	2000 Central Place of Urban Area
<input type="checkbox"/>	106th Congressional District
<input type="checkbox"/>	109th Congressional District
<input type="checkbox"/>	2000 State Legislative District, Upper Chamber
<input type="checkbox"/>	2000 State Legislative District, Lower Chamber
<input type="checkbox"/>	2000 Voting Districts
<input type="checkbox"/>	2000 3-Digit ZIP Code Tabulation Area
<input type="checkbox"/>	2000 5-Digit ZIP Code Tabulation Area
<input type="checkbox"/>	2000 School District, Elementary*
<input type="checkbox"/>	2000 School District, Secondary*
<input type="checkbox"/>	2000 School District, Unified*
<input type="checkbox"/>	2000 Traffic Analysis Zone*
<input type="checkbox"/>	2000 1% Public Use Microdata Area
<input type="checkbox"/>	2000 5% Public Use Microdata Area

* Data not available for this geographic type. Boundary provided for reference only.







List of Changes to Outdoor Lighting Zones				Last Update: 2/1/2006	
Zip Code	Adopted Lighting Zone	Default Lighting Zone	Description of the Physical Boundaries of Adopted Lighting Zone	County Name	City Name
91910	LZ3	LZ2	Future Eastern Urban Center: The area east of SR-125 extended 2800 feet east to Eastlake Park Way, and 2500 feet south of Olympic Parkway extended 3250 feet south to future Rock Mtn Rd.	County of San Diego	City of Chula Vista
91910	LZ3	LZ2	Future University Core: The area 5250 feet south of Olympic Parkway extended 1650 feet south to the future University Ave and 2400 feet east of SR-125 extended 2500 feet east.	County of San Diego	City of Chula Vista
91910	LZ3	LZ2	Future Village Town Center: The area east of SR-125 extended 2400 feet east and 5750 feet south of Olympic Parkway extended 1700 feet south to the future University Ave.	County of San Diego	City of Chula Vista
91910	LZ3	LZ2	FWY Commercial: The area that is bounded on the north by Olympic Parkway, on the west by SR-125, on the east by Eastlake Parkway and on the south by future Birch Road, 2500 feet south of Olympic Parkway.	County of San Diego	City of Chula Vista
91910	LZ3	LZ2	Sharp Chula Vista Center Campus: The area located 400 feet east of Brandywine Ave and extended 1300 feet east and 1300 feet south of Telegraph Canyon Rd.	County of San Diego	City of Chula Vista
91911	LZ3	LZ2	Chula Vista Auto Park: The area to the south of Main Street extended 600 feet south and 1300 feet east of 805 Freeway extended 1400 feet east.	County of San Diego	City of Chula Vista
91911	LZ3	LZ2	City of Chula Vista Crossing: The area to the south of Main Street extended 1200 feet south and east of 805 Freeway extended 1000 feet east.	County of San Diego	City of Chula Vista
91911	LZ3	LZ2	Future Industrial Park north of San Diego County Land Fill: 1000 feet to the northwest extended 3300 feet.	County of San Diego	City of Chula Vista

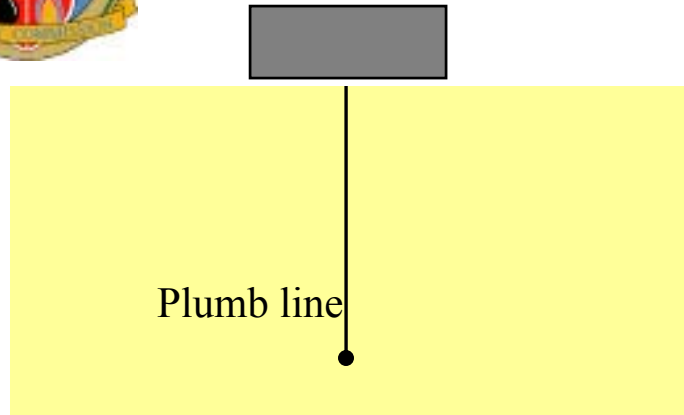


Outdoor Luminaire Cutoff Requirement

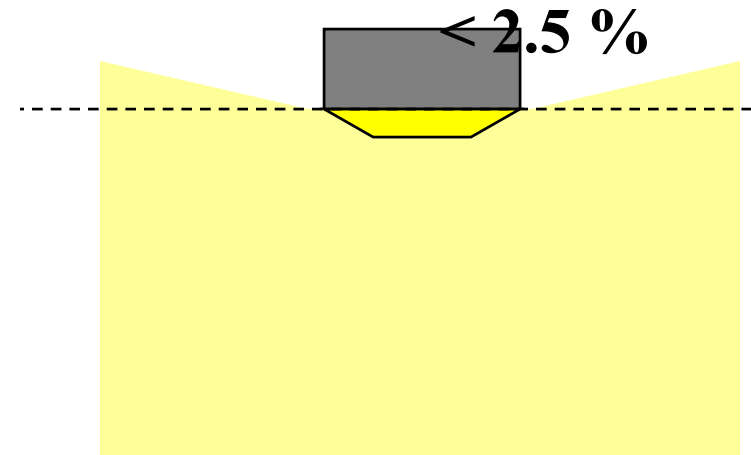
- Hardscape Areas
 - Parking lots
 - Building entrances
 - Canopies
 - Outdoor sales areas
- > 175 Watts
- Must be IESNA Cutoff (full cutoff also complies)
 - Must take into account mounting at a tilt



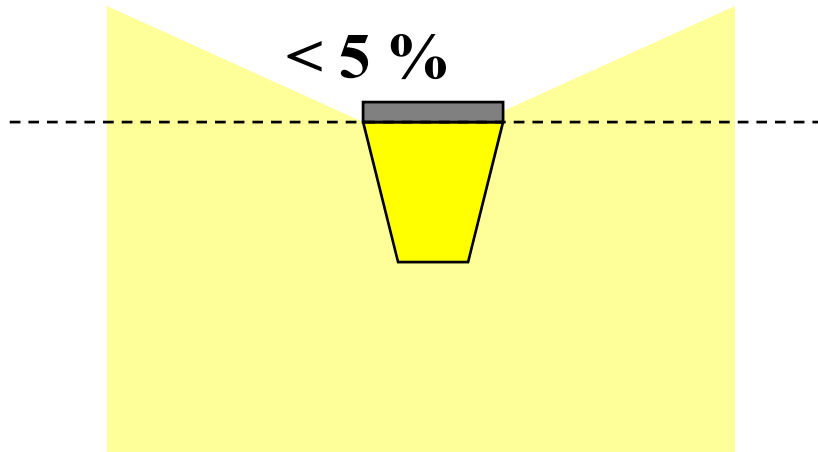
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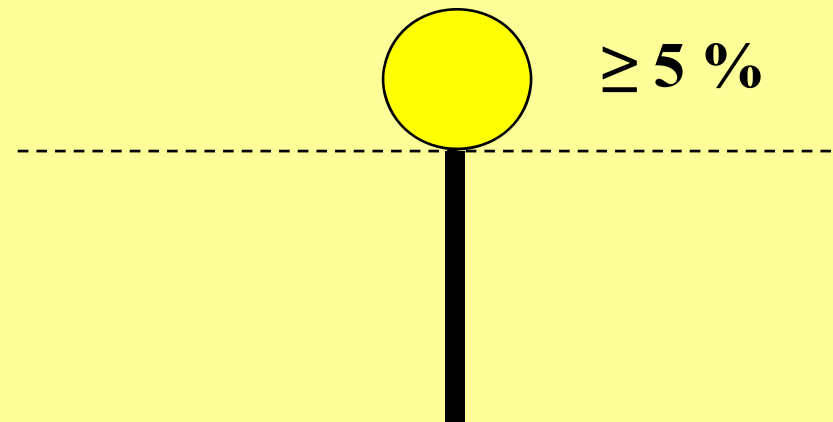
Full Cutoff



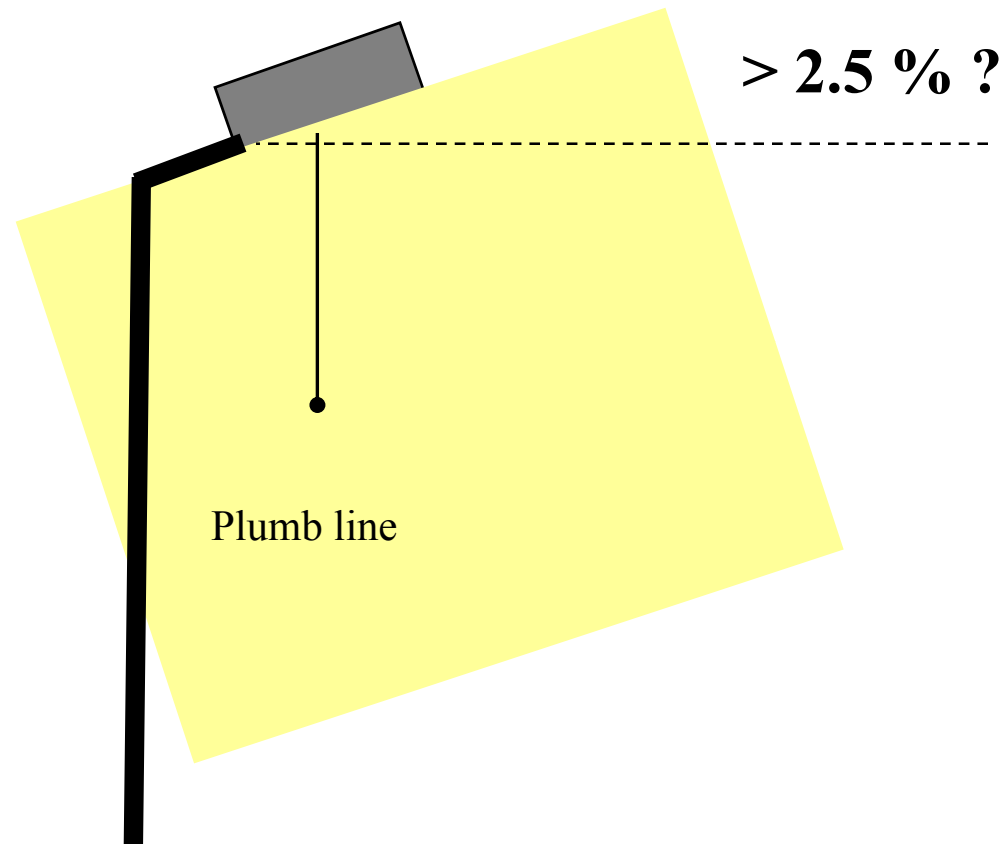
Cutoff



Semi-Cutoff



Non-Cutoff



Non-Compliant Full Cutoff



§ 132 Outdoor Lighting Controls

Existing exceptions to outdoor luminaire cutoff:

- Building facades, public monuments, statues, and vertical surfaces of bridges
- Required by health or life safety statute, ordinance, or regulations
- Temporary outdoor lighting
- Used around water subject to Article 680 of CEC



§ 132 Outdoor Lighting Controls

New exception to outdoor luminaire cutoff:

- Replacement of existing pole mounted luminaires in hardscape areas meeting all of the following conditions:
 - Existing luminaire not cutoff; and
 - Spacing between existing poles is greater than six times the mounting height of the existing luminaires; and
 - No additional poles added to the site; and
 - No new wiring to the luminaires; and
 - Connected lighting power wattage not increased



Motion Sensors on inefficient lighting technologies

If luminaire rated for over 100 watt lamp, shall have either:

- Lamp efficacy of 60 lumens per watt
- Or controlled by motion sensor



§ 132 Outdoor Lighting Controls

Exceptions to motion sensors

- Required by health or life safety statute, ordinance, or regulations
- Used around water subject to Article 680 of CEC
- Searchlights
- Theme lighting used in theme parks
- For film and live performances
- Temporary
- LED, **light emitting capacitors**, neon, cold cathode
- Sign



Multi-Level Switching

- Give owner ability to automatically turn off $\geq 50\%$ to $\leq 80\%$
 - Building facades
 - Parking lots
 - ~~➤ Garages~~
 - Canopies
 - Outdoor Sales Areas
 - **Student pick-up/drop-off zones**



§ 134 Nonresidential Lighting Controls Acceptance

- In 2005, Lighting Control Acceptance only applied to nonresidential indoor lighting controls
- In 2008, added: Certified that outdoor lighting controls shall meet the requirements of §119 and 132.



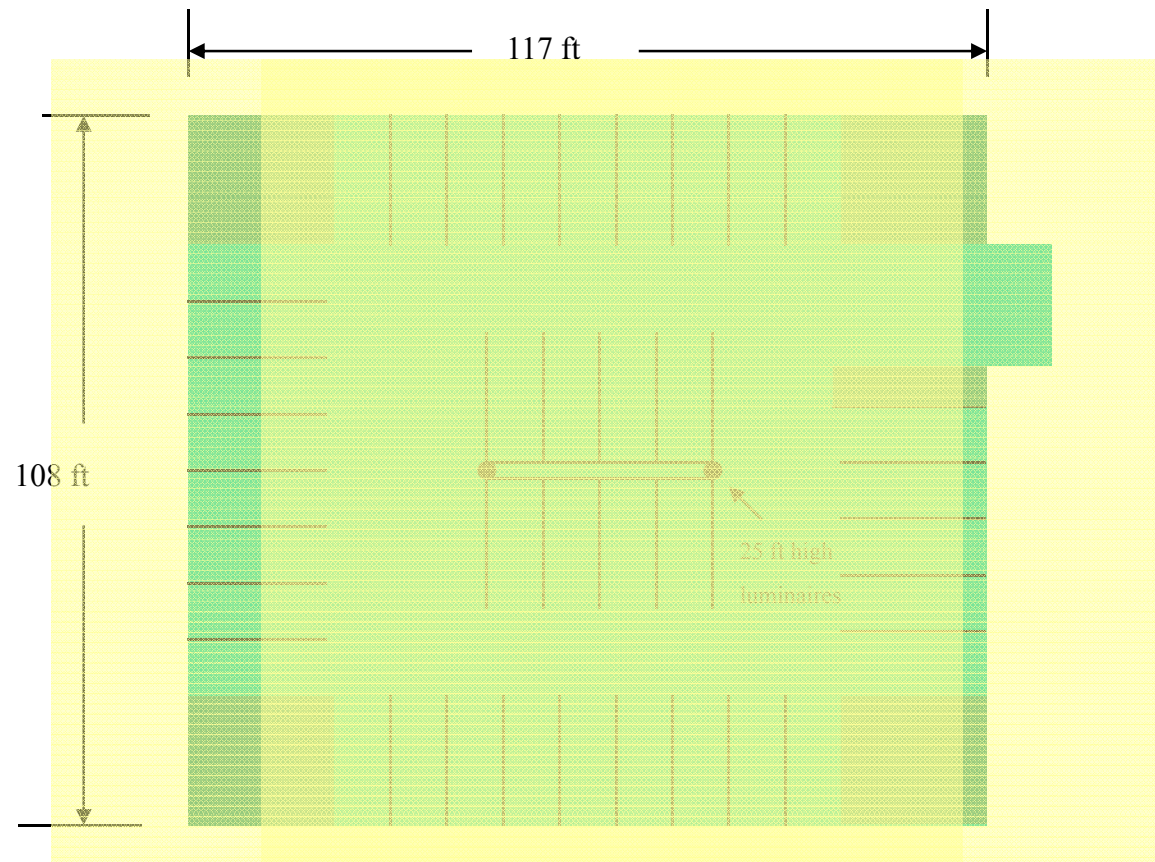
§ 147 Outdoor Lighting

Illuminated hardscape means:

- Square pattern **ten** times the luminaire mounting height with the luminaire in the middle of the pattern
- Shall not go beyond hardscape border or into buildings
- No double counting of any areas
- Hardscape areas which are not illuminated shall not be included in total square feet of site hardscape
- Solar powered lighting, or other “off the grid” lighting is not exempt from Title 24, Part 6

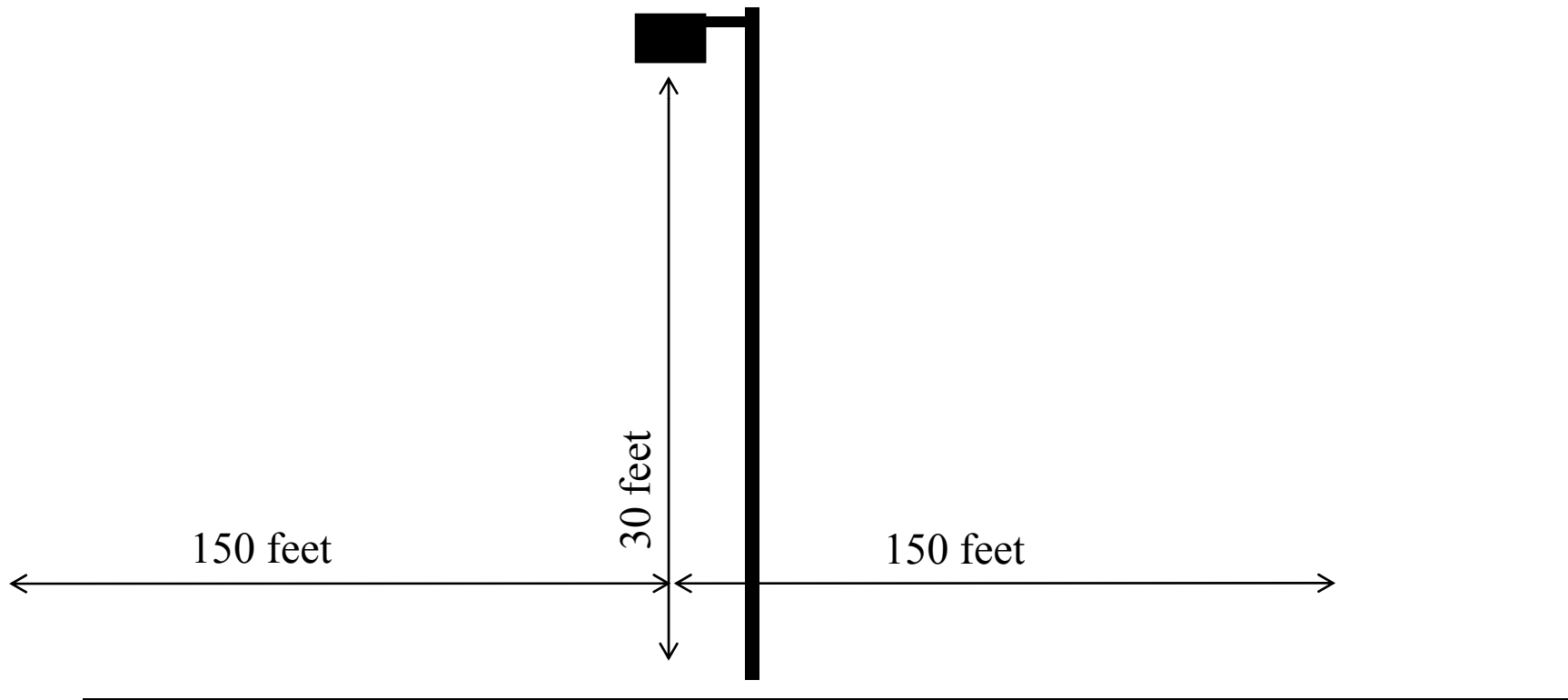


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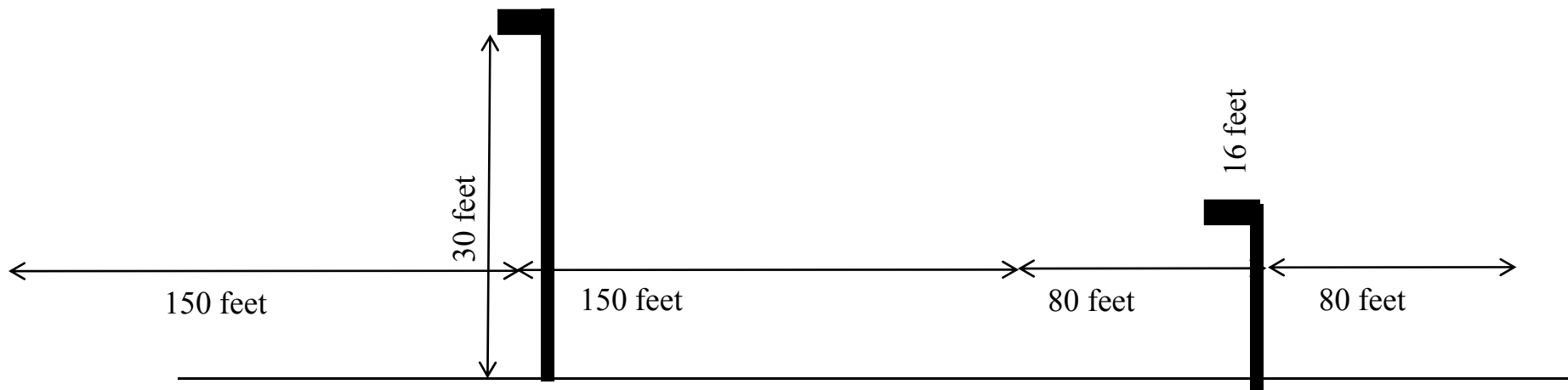


Illuminated Area



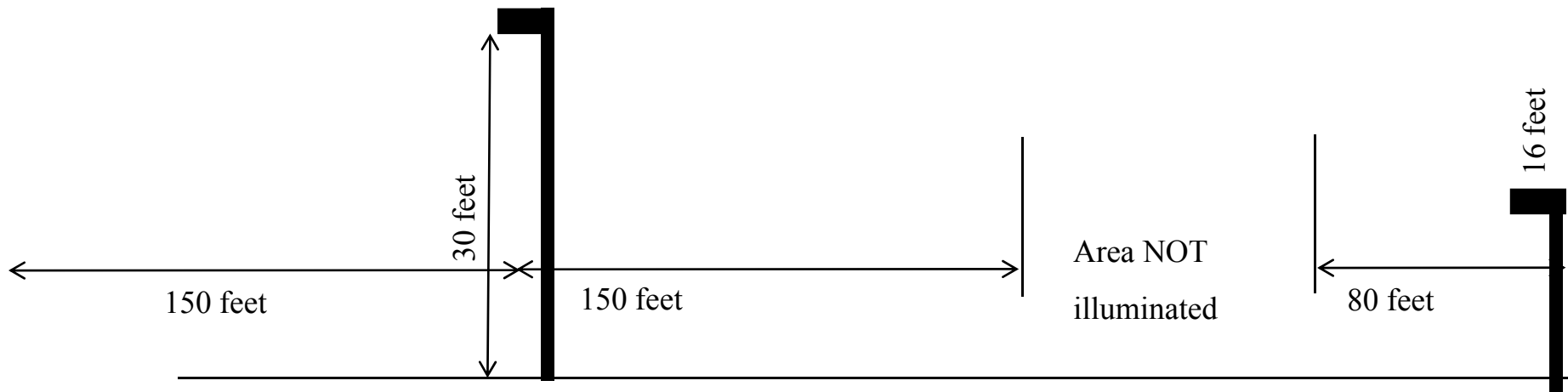


Illuminated Area



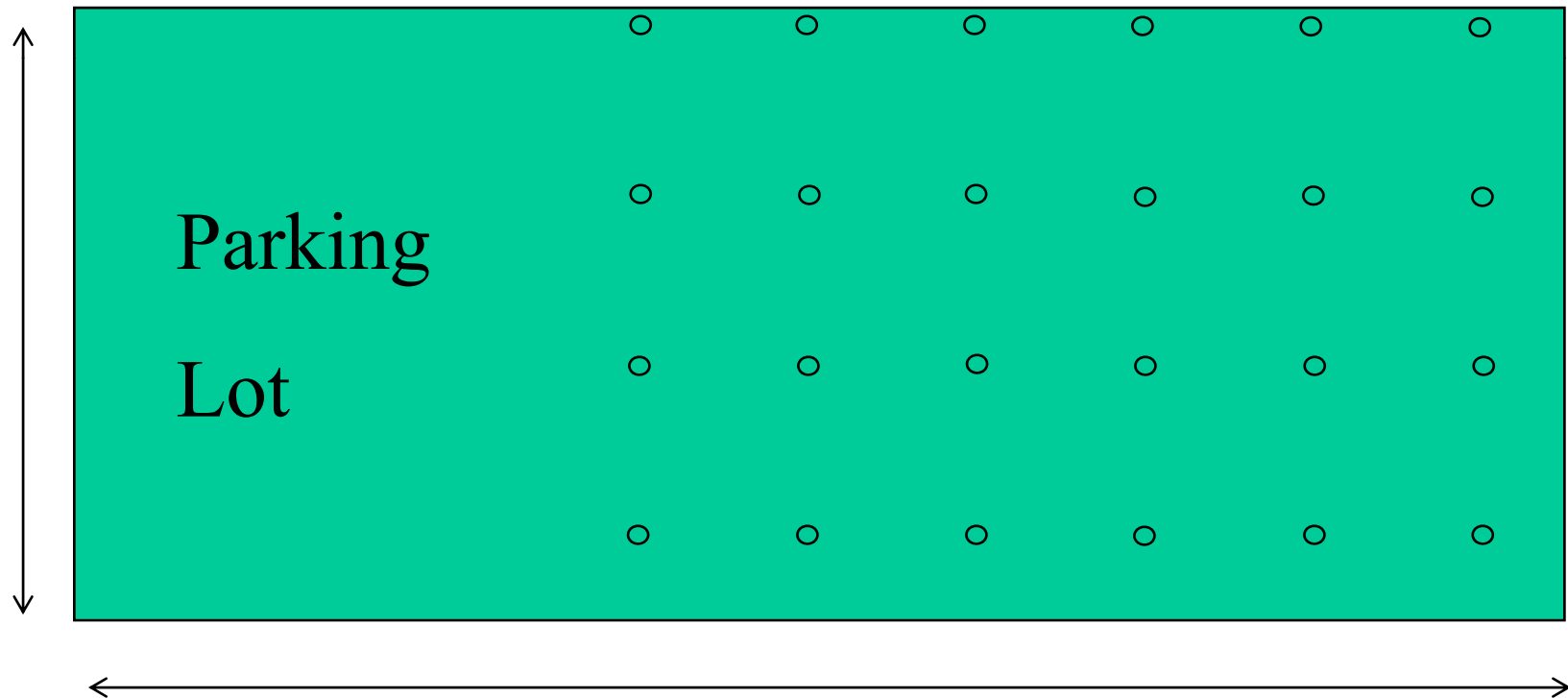


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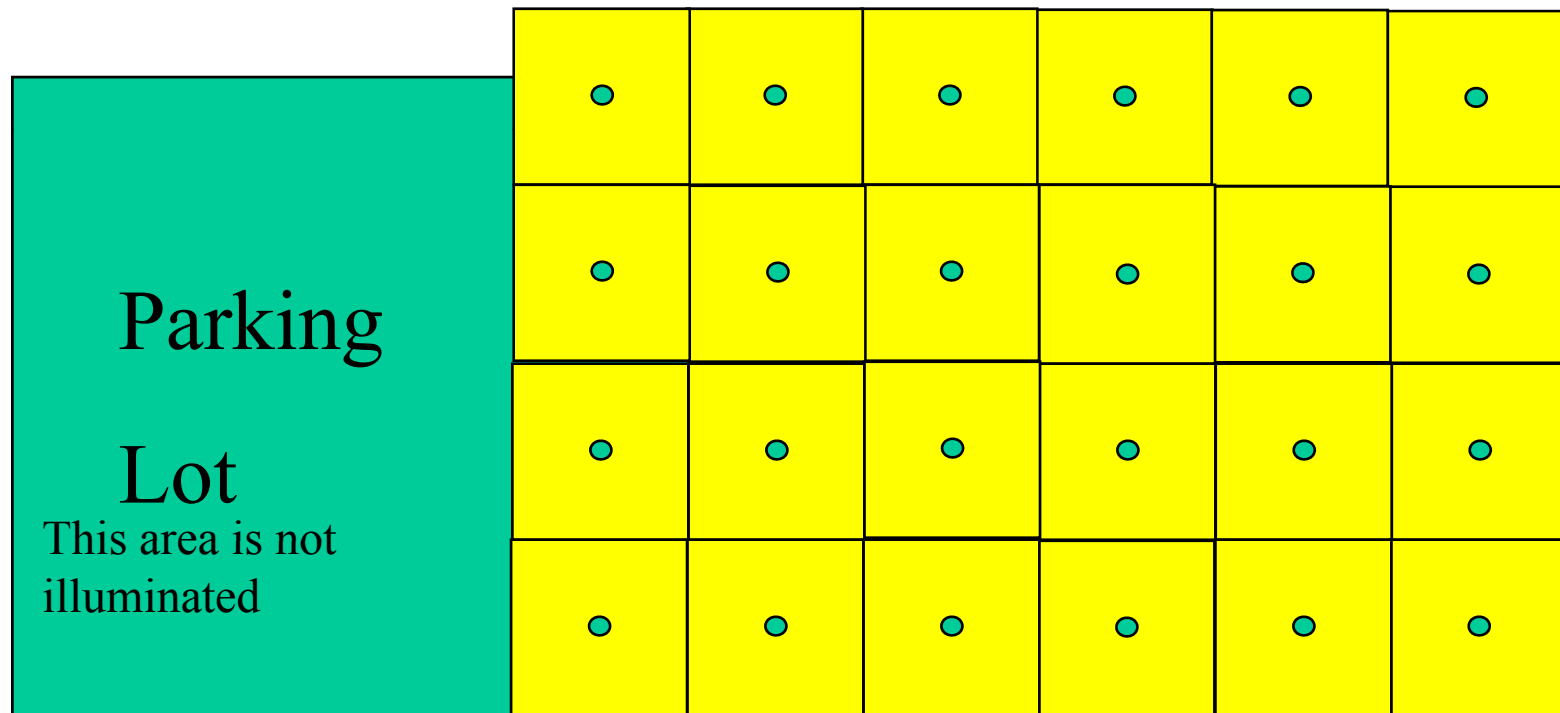


Illuminated Area





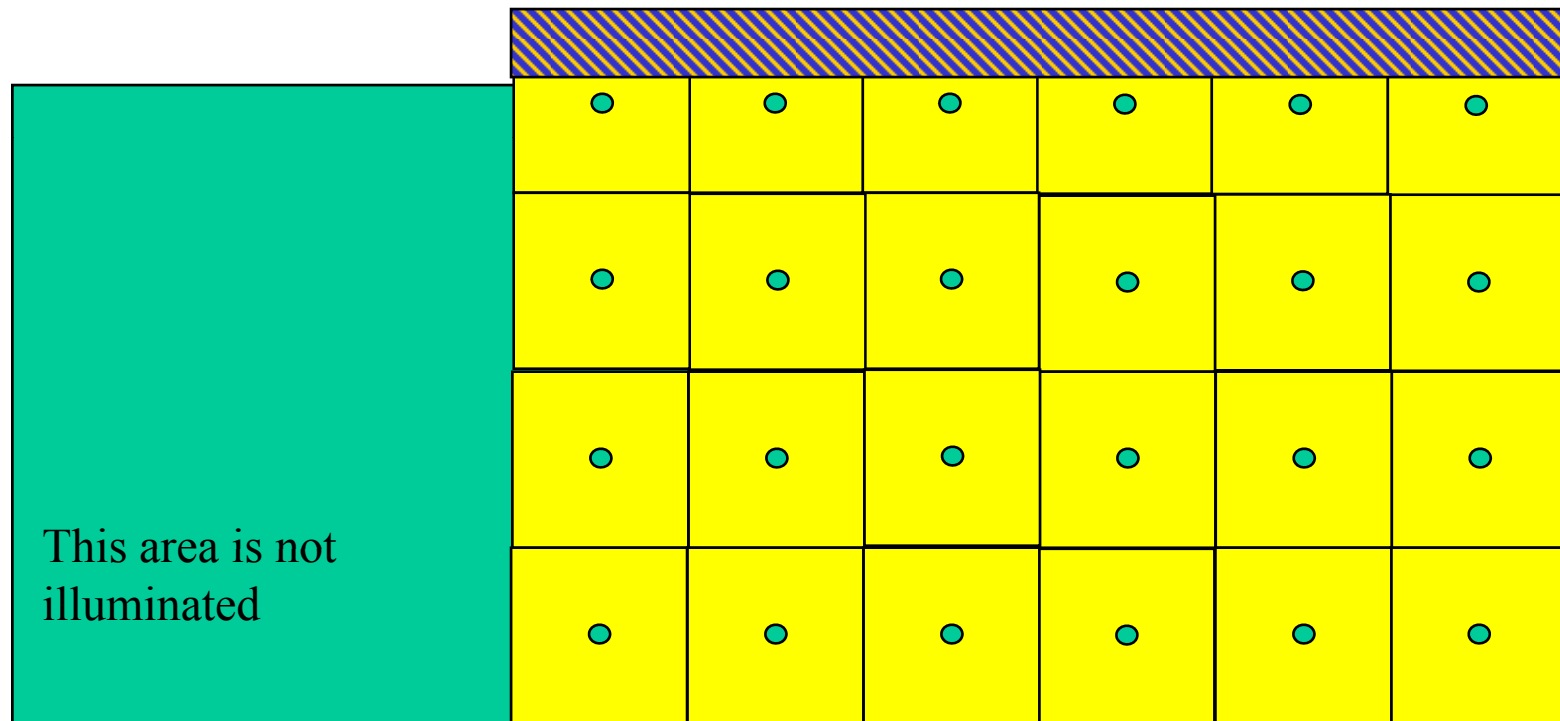
Illuminated Area





Illuminated Area

Do not count area within square pattern that is beyond the paved area





§ 147 Outdoor Lighting Exceptions

EXCEPTIONS to Section 147: When $\geq 50\%$ light from luminaire falls on one or more of the following applications, the lighting power for that luminaire shall be exempt from Section 147(b):

- Lighting specifically for Automated Teller Machine as required by California Financial Code Section 13040, or required by law through a local ordinance
- Lighting of tunnels, bridges, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.
- In theme parks: outdoor lighting for themes and special effects
- Lighting for outdoor theatrical and other outdoor live performances, provided additions to area lighting systems and controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators
- Outdoor lighting systems for qualified historic buildings if they consist solely of historic lighting components or replicas of historic lighting components



§ 147 Outdoor Lighting Exceptions (continued)

- Temporary
- Required FAA and Coast Guard
- Public Streets, roadways, highways, traffic signage
- Sports, athletic fields, children's playgrounds
- Industrial sites (rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, aviation facilities)
- Public monuments
- Around swimming pools & water features (CEC 680)
- Landscape



§ 147 Outdoor Lighting

New “Layered Method”

- Outdoor lighting language rewritten for clarity
- Repackaged for simplification of compliance forms and enforcement
- No longer break site into many puzzle pieces



§ 147 Outdoor Lighting

New “Layered Method”

- First layer = illuminated hardscape lighting power allowance for entire site
 - May trade off hardscape allowance within the site— provided entire hardscape remains illuminated
 - Must reduce total square feet of site hardscape if luminaires removed



§ 147 Outdoor Lighting

New “Layered Method”

- Other Specific Application “layers” available where appropriate
 - Each additional lighting power allowance is layered on the appropriate portion of site



§ 147 Outdoor Lighting

The general hardscape area of a site includes:

- Parking lots, roadways, driveways, sidewalks, walkways, bikeways, plazas, and other improved areas that are illuminated
- No longer differentiate between pedestrian and automotive hardscape
- No longer have methods 'i' and 'ii'



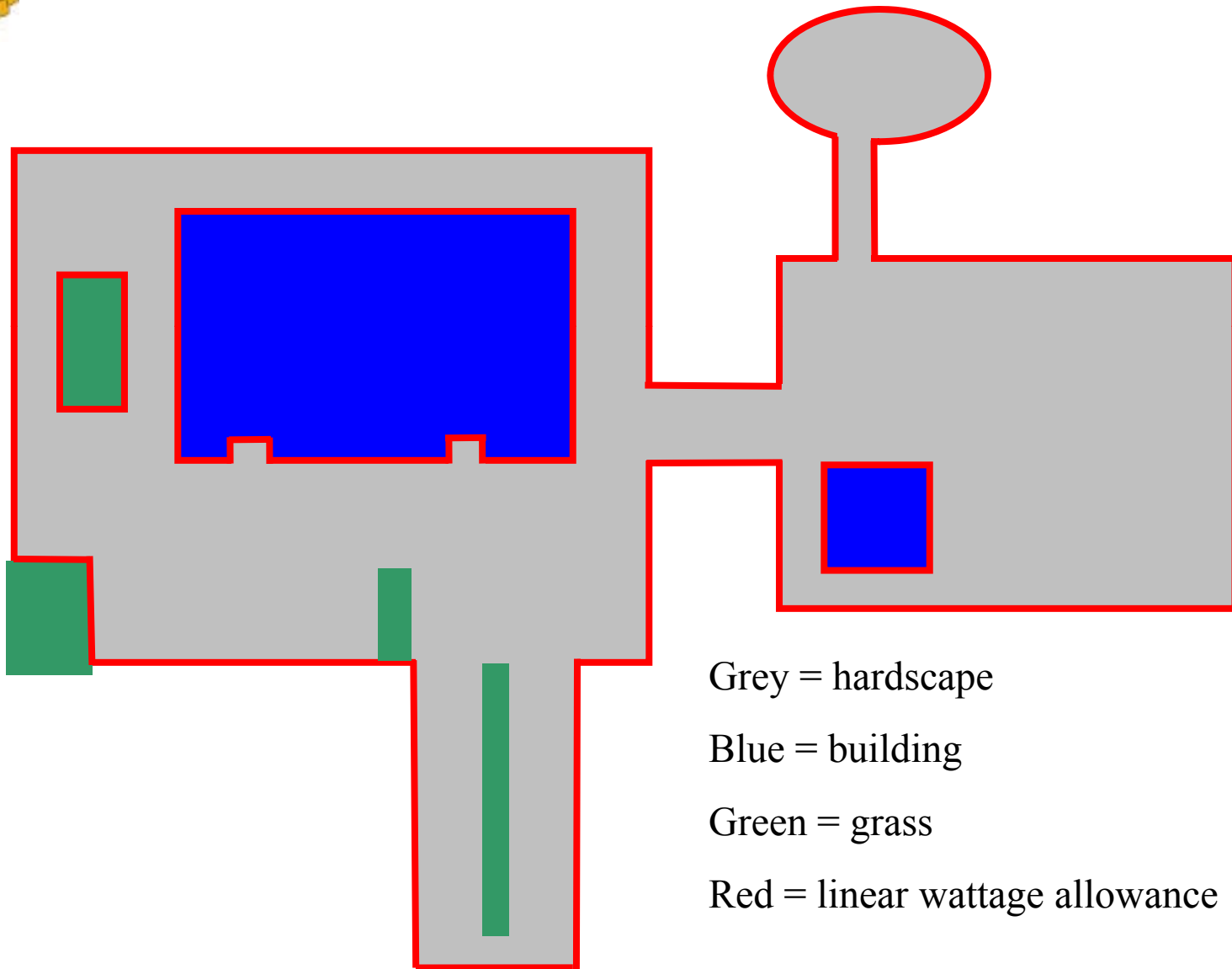
§ 147 Outdoor Lighting

TABLE 147-A GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE

Type of Power Allowance	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Area Wattage Allowance (AWA)	0.036 W/ft ²	0.045 W/ft ²	0.092 W/ft ²	0.115 W/ft ²
Linear Wattage Allowance (LWA)	0.36 W/lf	0.45 W/lf	0.92 W/lf	1.15 W/lf
Initial Wattage Allowance (IWA)	340 W	510 W	770 W	1030 W



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Grey = hardscape

Blue = building

Green = grass

Red = linear wattage allowance



§ 147 Outdoor Lighting

Additional Lighting Power Allowance for Specific Applications:

Shall be the smaller of:

- Additional lighting power allowances for specific applications
 - ✓ Determined from Table 147-B
 - ✓ For appropriate lighting zone
- Or the actual installed lighting power meeting the requirements for the allowance.



Additional Lighting Power Allowance for Specific Applications

Lighting Application	Lighting Zone 3
Building Entrances or Exits.	100 W
Primary Entrances to Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities.	120 W
Drive Up Windows.	125 W
Vehicle Service Station Uncovered Fuel Dispenser	185 W
Outdoor Sales Frontage	36 W/linear ft
Ornamental Lighting (based on ft ² of site hardscape)	0.04 W/ft ²
Building Facades	0.35 W/ft ²
Outdoor Sales Lots	0.758 W/ft ²



Additional Lighting Power Allowance for Specific Applications

Lighting Application	Lighting Zone 3
Vehicle Service Station Hardscape	0.308 W/ft ²
Vehicle Service Station Canopies	1.358 W/ft ²
Sales Canopies	0.908 W/ft ²
Non-sales Canopies	0.408 W/ft ²
Guard Stations	0.708 W/ft ²
Student Pick-up/Drop-off zone	0.45 W/ft ²
Outdoor Dining	0.258 W/ft ²
Special Security Lighting for Retail Parking and Pedestrian Hardscape.	0.019 W/ft ²



§ 147 Outdoor Lighting

Hardscape security exception for local ordinance

- For hardscape including parking lots, site roadways, driveways, sidewalks, walkways or bikeways
- When specific light levels are required by law through a local ordinance
 - ✓ Provided local ordinance has followed public process allowing formal public notification, review, and comment about the proposed change in accordance with §10-114
- The smaller of the following additional layer may be added:
 - ✓ Actual additional wattage, or
 - ✓ LPD specified in TABLE 147-C



§ 147 Outdoor Lighting

Hardscape security exception for local ordinance

Required light levels by law through a local ordinance (horizontal foot-candles, average)	When MINIMUM Light Levels Are Required Allowed Lighting Power Density (W/ft ²)	When AVERAGE Light Levels Are Required Allowed Lighting Power Density (W/ft ²)
0.5	0.04	0.05 0.02
1.0	0.08	0.07 0.04
1.5	0.16	0.10 0.06
2.0	0.20	0.12 0.08
3.0	0.20	0.19 0.12
4.0 or greater	0.20	0.25 0.16



§ 10-114 Outdoor Lighting Zones

- Public process required when adopting ordinances for minimum light levels



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Nonresidential Sign Lighting



§ 133 Sign Lighting Controls

2005	2008
Section 132 <ul style="list-style-type: none">• Outdoor Lighting Controls• Applied also to signs – unless listed as exempt under each measure	Section 133 <ul style="list-style-type: none">• Sign Lighting Controls• New section for only Sign lighting controls



§ 133 Sign Lighting Controls

2005	2008
	<ul style="list-style-type: none">• All signs (in and outdoor) controlled with automatic time switch control complying with §119
<ul style="list-style-type: none">• All <u>OUTDOOR</u> signs controlled with photocontrol or outdoor astronomical time switch control <p>EXEPTION: Tunnels and large covered areas requiring daytime illumination.</p>	



§ 133 Sign Lighting Controls

What is an Astronomical Time Switch Control?

- Time switch designed to control lighting based on sunrise and sunset hours
- Automatically adjusts the turning on and off of lights every day of the year.
- Typically internal program based on longitude and latitude of installation
- Must be certified to the Energy Commission according to § 119.



§ 133 Sign Lighting Controls

2005	2008
	<p data-bbox="674 708 1709 764">Outdoor Signs on Both Day and Night</p> <ul data-bbox="674 792 1688 971" style="list-style-type: none">• OUTDOOR signs controlled by dimmer with ABILITY to automatically reduce sign power by $\geq 65\%$ during night time. <p data-bbox="768 1003 1052 1052">EXEPTIONS</p> <ul data-bbox="768 1079 1808 1409" style="list-style-type: none">• Signs on < 1 hour during daylight hours• Outdoor signs in tunnels and large covered areas requiring daytime illumination• Metal Halide, HPS, cold cathode, Neon lamps used to illuminate signs or parts of signs



§ 133 Sign Lighting Controls

2005	2008
	<p>Electronic Message Center</p> <ul style="list-style-type: none">• With <u>NEW</u> connected power load > 15 kW• Shall install demand responsive control• Capable of reducing lighting power by $\geq 30\%$• When receiving demand signal sent out by local utility <p>EXCEPTION: EMC required by health or life safety statute, ordinance, or regulations including but not limited to exit signs and traffic signs.</p>

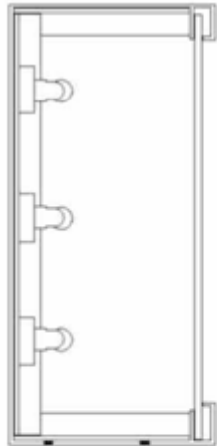


§ 148 Requirements for Signs

2005	2008
NO OUTDOOR LIGHTING ZONES	
Standards apply to both Indoor and Outdoor Signs	
Power allowances apply to: <ul style="list-style-type: none">internally illuminated signsexternally illuminated signs	
<ul style="list-style-type: none">Lighting controls apply to:internally illuminated signsexternally illuminated signs	<p>Lighting controls also apply to:</p> <ul style="list-style-type: none">unfiltered LED (light bulb is the sign)unfiltered neon (neon tube is the sign)



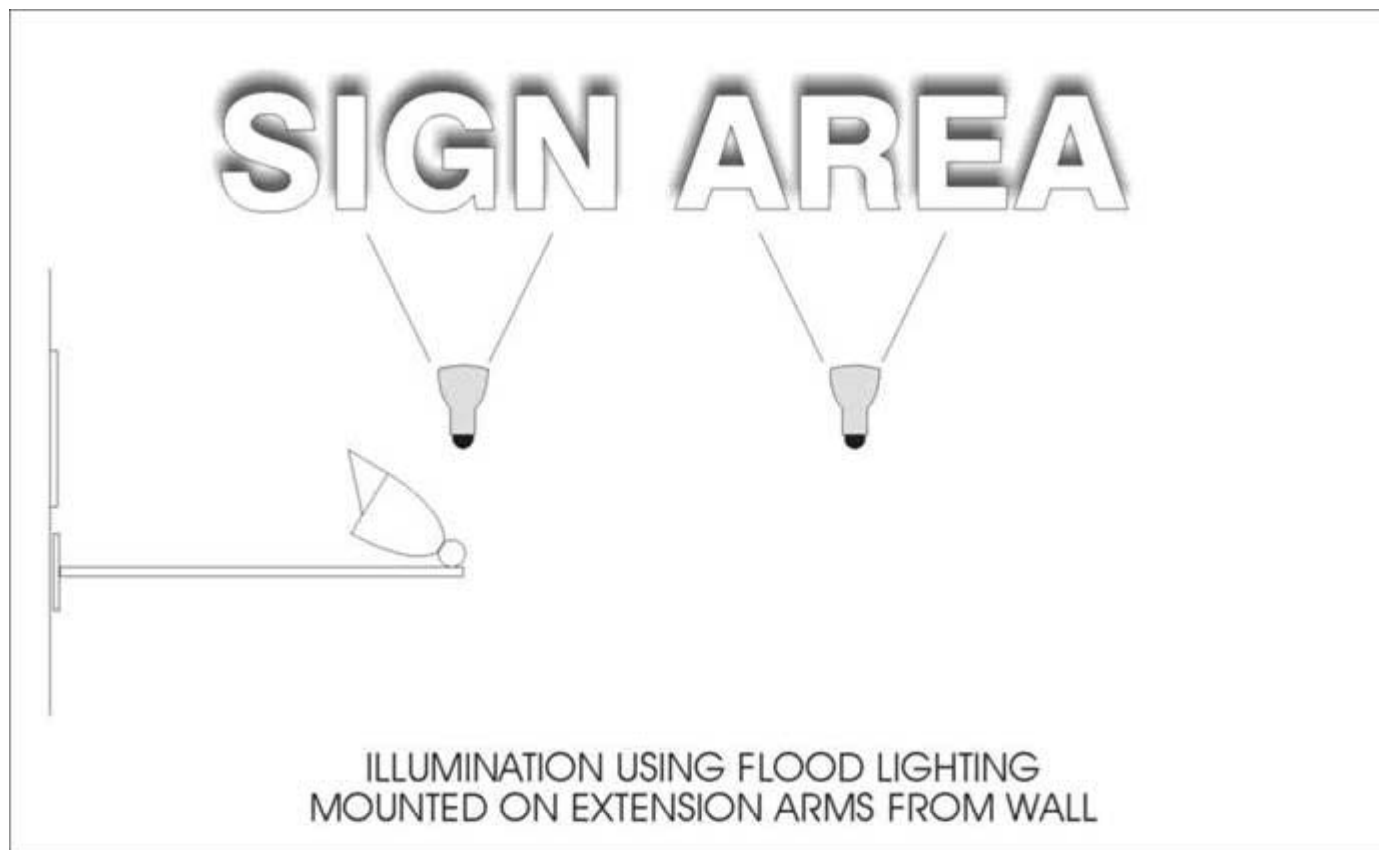
Internally illuminated sign



SINGLE FACED CABINET WITH FLUORESCENT LAMP ILLUMINATION
WITH TRANSLUCENT FACE



Externally illuminated sign





§ 148 Requirements for Signs

2005	2008
<ul style="list-style-type: none">• 12 watts per square foot internal illumination• 2.3 watts per square foot external illumination <p>OR</p> <p>Alternative compliance option:</p> <ul style="list-style-type: none">• Equipped only with one or more of the light sources shown on the following slides	



§ 148 Alternate Compliance

2005	2008
Equipped with only one or more of the following light sources:	
<ul style="list-style-type: none">• High pressure sodium	
<ul style="list-style-type: none">• Compact fluorescent lamps that do not contain a medium screw base sockets (E24/E26)	
<ul style="list-style-type: none">• Electronic ballasts with a fundamental output frequency not less than 20 kHz,	
<ul style="list-style-type: none">• Barrier coat rare earth phosphor fluorescent lamps	<ul style="list-style-type: none">• Fluorescent lamps with a minimum color rendering index (CRI) of 80



§ 148 Alternate Compliance

2005	2008
Equipped with only one or more of the following light sources:	
<ul style="list-style-type: none">• Neon	<ul style="list-style-type: none">• Neon or cold cathode with transformer or power supply efficiency \geq the following: \geq <u>75% efficiency</u> When transformer or power supply rated output current < 50 mA, or \geq <u>68% efficiency</u> When transformer or power supply rated output current ≥ 50 mA
<ul style="list-style-type: none">• Cold cathode	



§ 148 Alternate Compliance

2005	2008
Equipped with only one or more of the following light sources:	
<ul style="list-style-type: none">• Pulse start or ceramic metal halide	<ul style="list-style-type: none">• Pulse start or ceramic metal halide with:<ul style="list-style-type: none">✓ $\geq 88\%$ efficiency ballastOR• Pulse start ≤ 320 watts with:<ul style="list-style-type: none">✓ $\geq 80\%$ efficiency ballast✓ are not 250 watt✓ are not 175 watt
Where: Ballast efficiency is tested according to ANSI C82.6-2005	



§ 148 Alternate Compliance

2005	2008
Equipped with only one or more of the following light sources:	
• LED	• LED with a power supply efficiency $\geq 80\%$
	<ul style="list-style-type: none">• Following LED power supplies shall comply with Appliance Efficiency Regulations (Title 20):<ul style="list-style-type: none">✓ Single voltage external power supplies, and also are✓ designed to convert 120 volt AC input into lower voltage DC or AC output and has✓ nameplate output power ≤ 250 W



Appliance Efficiency Regulations (Title 20)

Table U-2 Standards for Power Supplies

Nameplate Output	Minimum Efficiency in Active Mode
< 1 watt	0.5 times Nameplate Output
≥ 1 W and ≤ 51 W	0.09 times Nameplate Output + 0.5
> 51 watts	0.85
Where Nameplate Output = Natural logarithm of the nameplate output expressed in watts.	
Maximum Energy Consumption in No-Load Mode	
Any output	0.5 watts



Exceptions to § 148

2005	2008
Signs not required to meet the lighting power requirements:	
<ul style="list-style-type: none">Unfiltered signs	Unfiltered incandescent lamps which are: <ul style="list-style-type: none">Not part of an electronic message centerNot part of internally illuminated signNot part of externally illuminated sign
<ul style="list-style-type: none">Traffic signs shall meet T20	
<ul style="list-style-type: none">Exit signs shall meet T20	



Questions ?



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*Thank
You*