2013 Energy Standards Nonresidential Indoor Lighting

Daniel Wong
Standards Implementation Office
Efficiency Division

ICC San Joaquin Valley Chapter
SCE Energy Education Center, Tulare
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Goals for this Presentation

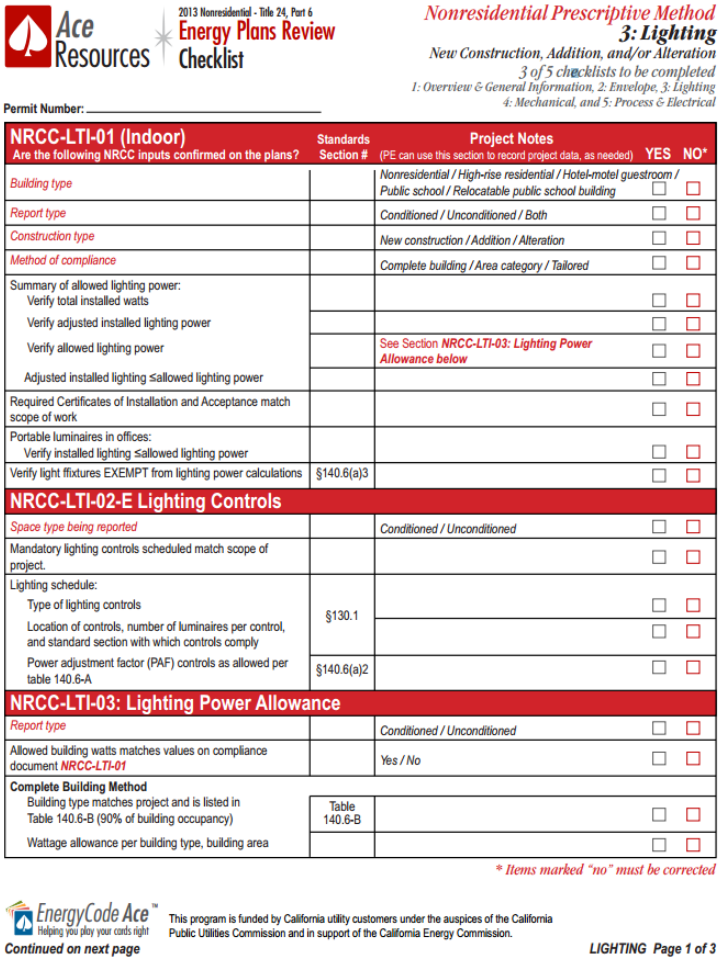
- **Simplify Energy Standards requirements for Nonresidential Lighting:**
  - Indoor lighting
  - Lighting controls
  - Acceptance testing

What does a Plans Examiner do?

- **Verify lighting wattage meet Certificate of Compliance**
  - i.e. LPDs (W/ft^2)
- **Verify mandatory measures are met**
  - Lighting Controls
- **Verify applicable Acceptance & Installation forms are specified**

Simplify Plan Review with Plans Review Checklist

- **Plan Review Checklist by EnergyCodeAce**
  - Specifies which components to verify on plans and NRCC forms
  - http://energycodeace.com/content/resources-checklists/



Ace Resources — 2013 Nonresidential - Title 24, Part 6 Energy Plans Review Checklist

Nonresidential Prescriptive Method
3: Lighting
New Construction, Addition, and/or Alteration
3 of 5 checklists to be completed
1: Overview & General Information, 2: Envelope, 3: Lighting 4: Mechanical, and 5: Process & Electrical

Permit Number: _____

NRCC-LTI-01 (Indoor) Are the following NRCC inputs confirmed on the plans?	Standards Section #	Project Notes (PE can use this section to record project data, as needed)	YES	NO*
Building type		*Nonresidential / High-rise residential / Hotel-motel guestroom / Public school / Relocatable public school building*	☐	☐
Report type		*Conditioned / Unconditioned / Both*	☐	☐
Construction type		*New construction / Addition / Alteration*	☐	☐
Method of compliance		*Complete building / Area category / Tailored*	☐	☐
Summary of allowed lighting power: Verify total installed watts			☐	☐
Verify adjusted installed lighting power			☐	☐
Verify allowed lighting power		See Section ***NRCC-LTI-03: Lighting Power Allowance below***	☐	☐
Adjusted installed lighting ≤allowed lighting power			☐	☐
Required Certificates of Installation and Acceptance match scope of work			☐	☐
Portable luminaires in offices: Verify installed lighting ≤allowed lighting power			☐	☐
Verify light ffixtures EXEMPT from lighting power calculations	§140.6(a)3		☐	☐
NRCC-LTI-02-E Lighting Controls				
Space type being reported		*Conditioned / Unconditioned*	☐	☐
Mandatory lighting controls scheduled match scope of project.			☐	☐
Lighting schedule: Type of lighting controls	§130.1		☐	☐
Location of controls, number of luminaires per control, and standard section with which controls comply			☐	☐
Power adjustment factor (PAF) controls as allowed per table 140.6-A	§140.6(a)2		☐	☐
NRCC-LTI-03: Lighting Power Allowance				
Report type		*Conditioned / Unconditioned*	☐	☐
Allowed building watts matches values on compliance document ***NRCC-LTI-01***		*Yes / No*	☐	☐
Complete Building Method Building type matches project and is listed in Table 140.6-B (90% of building occupancy)	Table 140.6-B		☐	☐
Wattage allowance per building type, building area			☐	☐

** Items marked "no" must be corrected*

EnergyCode Ace — Helping you play your cards right

This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy Commission.

Continued on next page

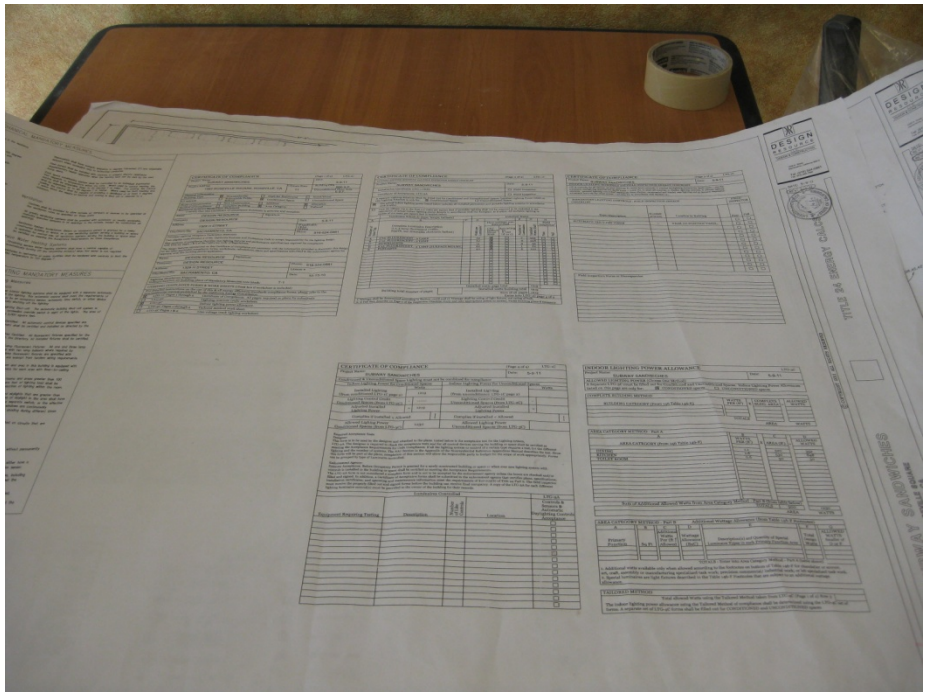
Were all applicable NRCC forms Submitted? NRCC-LTI

- **LTI-01:** Indoor Lighting
- **LTI-02:** Lighting Controls
- **LTI-03:** Power Allowance
- **LTI-04:** Tailored Method
- **LTI-05:** Line voltage track lighting

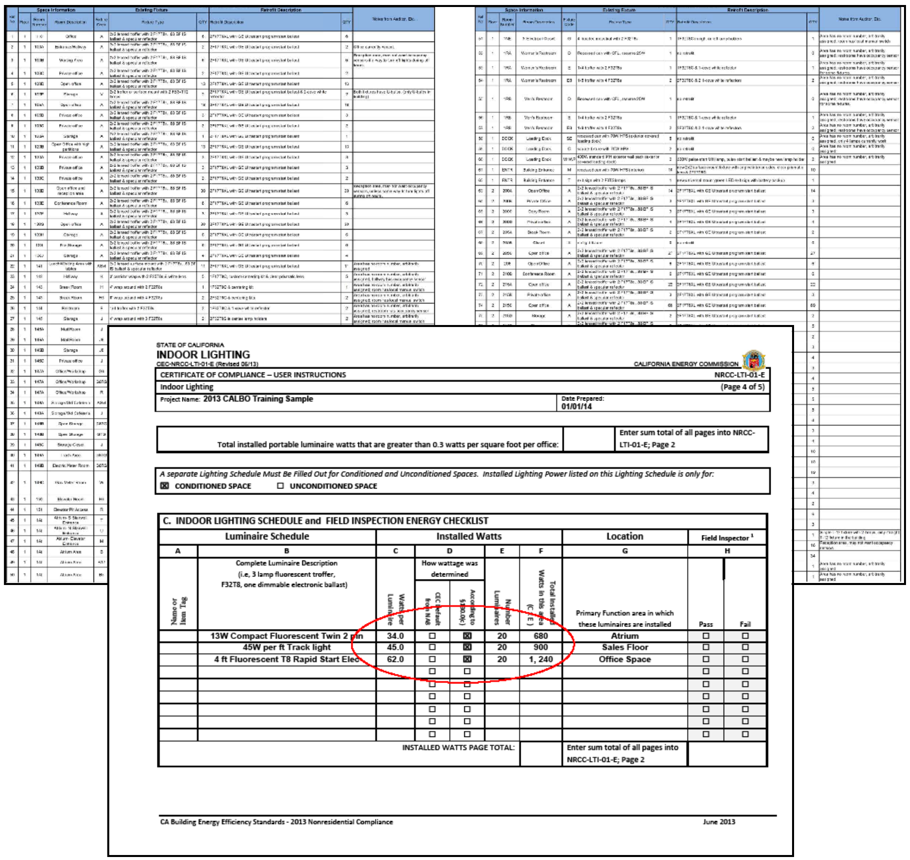
**** Forms should be incorporated onto plans***

§10-103 and the Plans Examiner

- **Verify required Certificate of Compliance on plans**
  - NRCC-LTI-01, 02 and 03 are required for all submittals
  - NRCC-LTI-04 only required for Tailored Method
  - NRCC-LTI-05 only required when track lighting is specified



§140.6 and the Plans Examiner



STATE OF CALIFORNIA
INDOOR LIGHTING
CEC-NRCC-LTI-01-E (Revised 06/13)
CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE – USER INSTRUCTIONS NRCC-LTI-01-E
Indoor Lighting (Page 4 of 5)
Project Name: 2013 CALBO Training Sample
Date Prepared: 01/01/14

Total installed portable luminaire watts that are greater than 0.3 watts per square foot per office: | Enter sum total of all pages into NRCC-LTI-01-E; Page 2

A separate Lighting Schedule Must Be Filled Out for Conditioned and Unconditioned Spaces. Installed Lighting Power listed on this Lighting Schedule is only for:
☒ CONDITIONED SPACE ☐ UNCONDITIONED SPACE

C. INDOOR LIGHTING SCHEDULE and FIELD INSPECTION ENERGY CHECKLIST

Luminaire Schedule		Installed Watts					Location	Field Inspector[1]	
A	B	C	D		E	F	G	H	
Name or Item Tag	Complete Luminaire Description (i.e, 3 lamp fluorescent troffer, F32T8, one dimmable electronic ballast)	Watts per Luminaire	How wattage was determined: CEC Default from NA8	According to §130.0(c)	Number Luminaires	Total Installed Watts in this area (C x E)	Primary Function area in which these luminaires are installed	Pass	Fail
	13W Compact Fluorescent Twin 2 pin	34.0	☐	☒	20	680	Atrium	☐	☐
	45W per ft Track light	45.0	☐	☒	20	900	Sales Floor	☐	☐
	4 ft Fluorescent T8 Rapid Start Elec	62.0	☐	☒	20	1, 240	Office Space	☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
				INSTALLED WATTS PAGE TOTAL:			Enter sum total of all pages into NRCC-LTI-01-E; Page 2		

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance June 2013

- **Verify proposed watts/ft^2 on NRCC-LTI-01 form**
  - ➢ Values should match lighting schedule on electrical plans
- **Verify applicable Certificate of Acceptance and Installation forms specified on NRCC-LTI-01**

Let's Discuss Mandatory Indoor Lighting Requirements

Mandatory Indoor Lighting Requirements

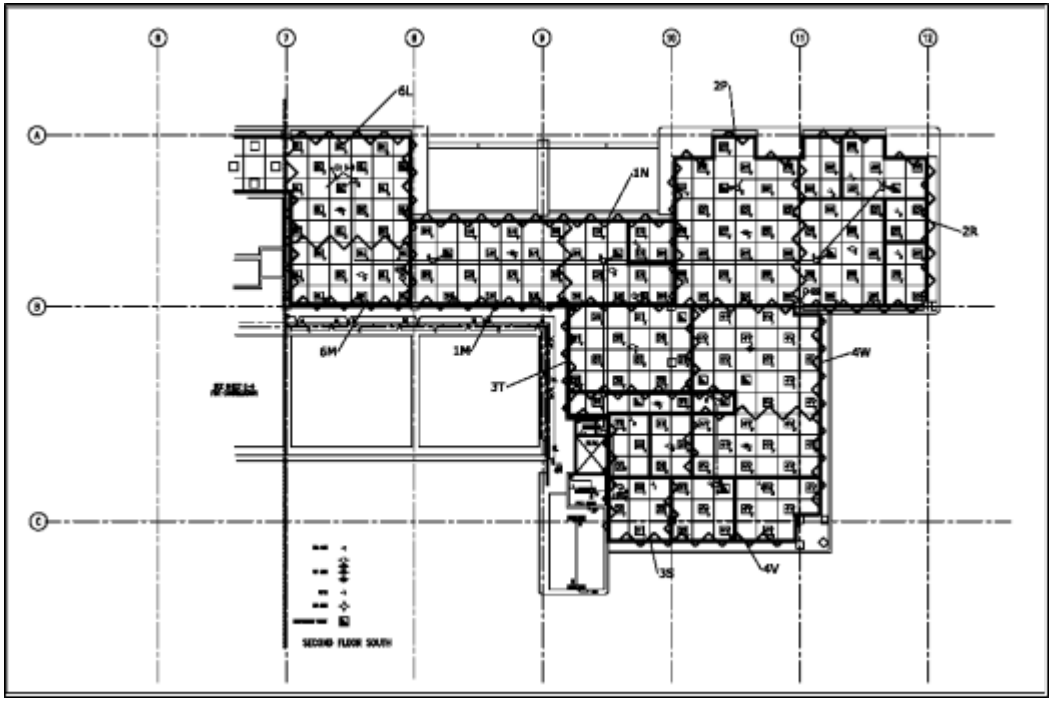
- **Mandatory req. include:**
  - Requirements for lighting control devices & systems (§110.9)
  - Lighting Controls
  - Acceptance Testing

Mandatory Indoor Lighting Controls

Section	Control Type
§130.1(a)	Area Controls
§130.1(b)	Multi-Level Lighting Controls
§130.1(c)	Shut-OFF Controls
§130.1(d)	Automatic Daylighting Controls
§130.1(e)	Demand Responsive Controls

Area Controls

§130.1(a)



- **Does each space have manual ON/OFF control?**
  - Each space separately controlled
  - Readily accessible
- **Verify on electrical plans**

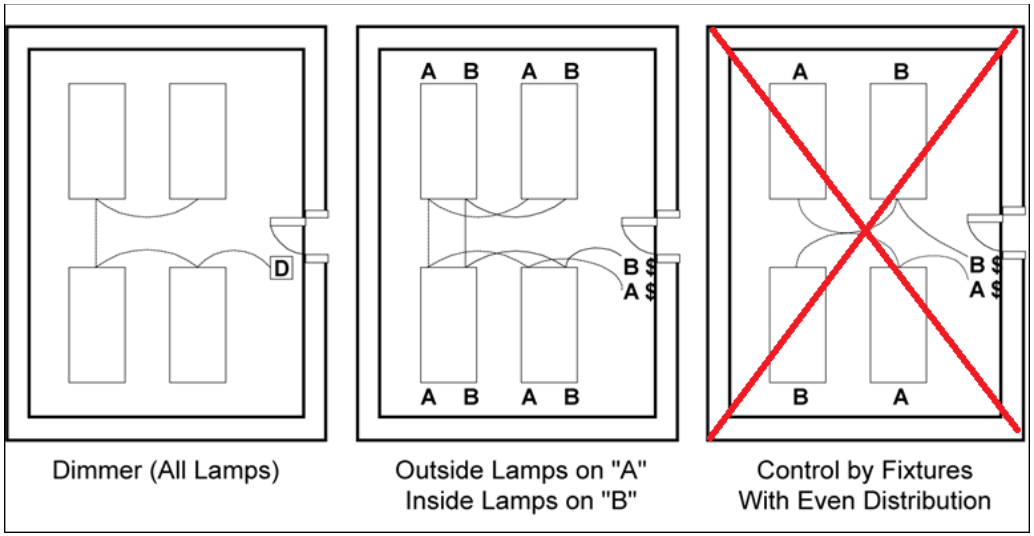
Area Controls

§130.1(a)

- **General Lighting controlled separately from other lighting types:**
  - Display
  - Ornamental
  - Special effects
  - Display case

Multi-Level Lighting Control
§130.1(b)

- **Do required spaces have multi-level controls?**
  - General lighting only
  - ≥ 100 ft^2; and
  - > 0.5 W/ft^2
- **Verify on electrical plans:**
  - Multi-level control meets TABLE 130.1-A



Multi-Level Lighting Control

§130.1(b)

- **TABLE 130.1-A**
- **Most luminaire types require:**
  - ➢ Continuous dimming; or
  - ➢ Step dimming; or
  - ➢ Switching alternate lamps
- **A/B or "checker board" switching not allowed**

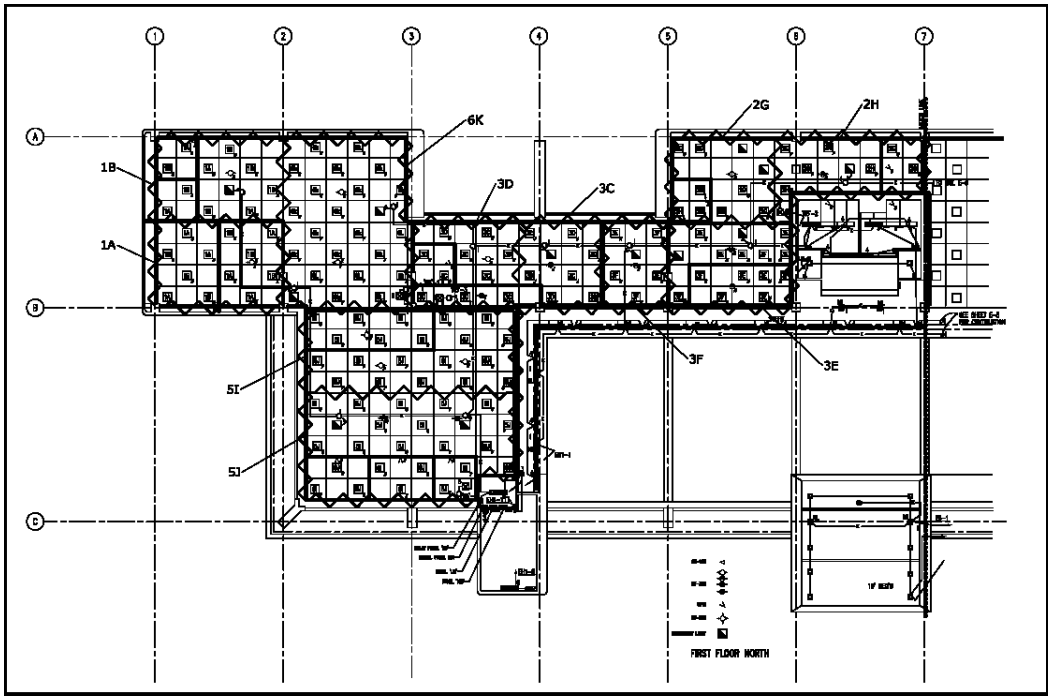
TABLE 130.1-A MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS

Luminaire Type	Minimum Required Control Steps (percent of full rated power[1])				Uniform level of illuminance shall be achieved by:
Line-voltage sockets except GU-24	Continuous dimming 10-100 percent				
Low-voltage incandescent systems					
LED luminaires and LED source systems					
GU-24 rated for LED					
GU-24 sockets rated for fluorescent > 20 watts	Continuous dimming 20-100 percent				
Pin-based compact fluorescent > 20 watts[2]					
GU-24 sockets rated for fluorescent ≤ 20 watts	Minimum one step between 30-70 percent				Stepped dimming; or Continuous dimming; or Switching alternate lamps in a luminaire
Pin-based compact fluorescent ≤ 20 watts[2]					
Linear fluorescent and U-bent fluorescent ≤ 13 watts					
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range:				Stepped dimming; or Continuous dimming; or switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire, illuminating the same area and in the same manner
	20-40 %	50-70 %	80-85 %	100 %	
Track Lighting	Minimum one step between 30 – 70 percent				Step dimming; or Continuous dimming; or Separately switching circuits in multi-circuit track with a minimum of two circuits.
HID > 20 watts	Minimum one step between 50 - 70 percent				Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner.
Induction > 25 watts					
Other light sources					

1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor
2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps

Shut-OFF Controls

§130.1(c)



Are shut-off controls specified?

- Occupant Sensing; or
- Automatic time switch
  - Must have override control

Verify on electrical plans

Shut-OFF Controls

§130.1(c)

- **Some areas require occupancy sensors**
- **Areas where occupant sensing control are required to shut-off all lighting:**
  - Offices 250 ft^2 or smaller
  - Multipurpose rooms less than 1,000 ft^2
  - Classrooms
  - Conference rooms

Shut-OFF Controls

§130.1(c)

- **Areas where partial ON/OFF occupant sensing controls are required in addition to shut-off control:**
  - Aisle ways and open areas in warehouses
  - Library book stack aisles
  - Corridors and stairwells
- **Reduce lighting by at least 50% when space is unoccupied**
- **Shut-off ALL lighting when space typically unoccupied**

Shut-OFF Controls

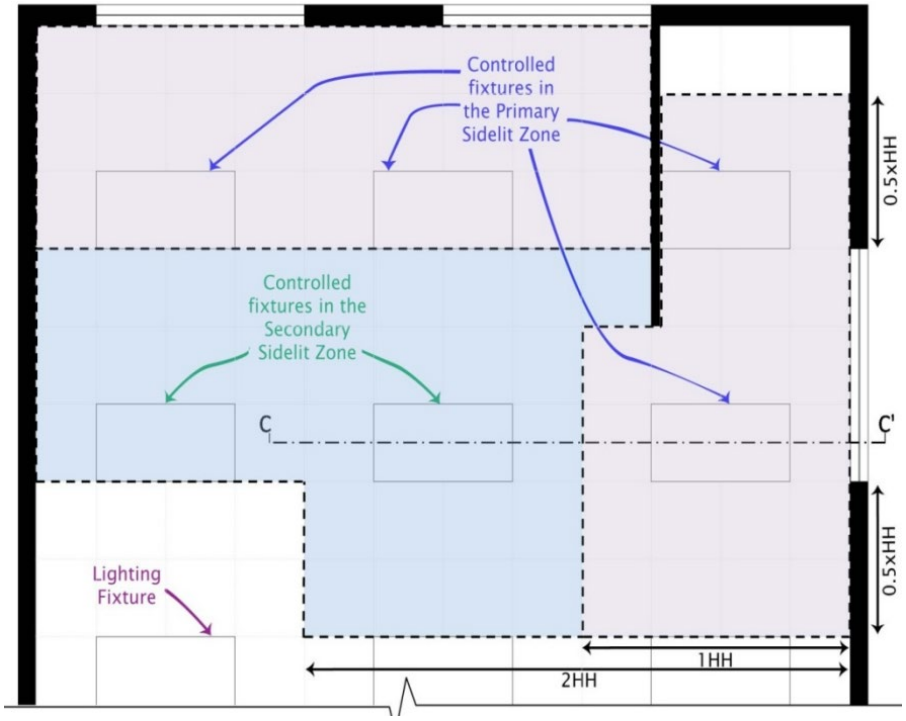
§130.1(c)

- **Areas where partial ON/OFF occupant sensing controls required instead of shut-off control:**
  - Stairwells and common area corridors
    - In hotels/motels, high rise res
  - Parking garages
  - Parking areas
  - Loading/unloading areas
- **Lighting not required to be fully shut-off in these areas**

Automatic Daylighting Controls

§130.1(d)

- **Are daylight controls specified? Req. if:**
  - ≥ 120 watts of lighting within the daylit zone; and
  - ≥ 24 ft^2 glazing area
- **Daylit zones required to be shown on plans**



Automatic Daylighting Controls
§130.1(d)

- **Automatic Daylight Controls:**
  - Apply to general lighting only
  - Lighting in daylit zones must be separately controlled
    - Skylit Daylit Zone
    - Primary Sidelit Daylit Zone
  - Meet uniformity req. of TABLE 130.1-A

Automatic Daylighting Controls
§130.1(d)

- **Are daylight controls specified in the Parking Garage?**
  - ≥ 60 watts of lighting in primary sidelit zone; and
  - ≥ 36 ft^2 of glazing or opening
  - Automatic daylighting control can be multilevel, continuous dimming or ON/OFF

Demand Responsive Controls

§130.1(e)

- **Are DR controls specified? Req. if:**
  - Building is greater than 10,000 ft^2
- **DR control should be capable of reducing total lighting power by minimum 15%**
  - Spaces with LPD < 0.5 W/ft^2 do not count toward total lighting power
  - Non-habitable spaces cannot be used to satisfy this requirement
    - Closets, storage areas, etc.

Demand Responsive Controls
§130.1(e)

- **Areas with LPD less than 0.5 W/ft^2 not counted toward 10,000 ft^2 trigger**
  - Clarified in May-June Blueprint Newsletter

- **Example:**
  - 15,000 ft^2 parking garage
  - Parking Area LPD 0.14 W/ft^2
  - 500 ft^2 elevator lobby with LPD of 0.6 W/ft^2
    - Should Demand Response control be required in this space?

Questions on Mandatory Req.?

Let's Discuss Prescriptive Indoor Lighting Requirements

Prescriptive Indoor Lighting Requirements

- **Prescriptive req. include:**
  - Calculation of indoor lighting power
  - Power adjustment factors
  - Automatic daylight control in secondary daylit zones

Calculation of Allowed Lighting Power

§140.6(c)

- **Three methods for compliance:**
  - Complete building method (TABLE 140.6-B)
  - Area category method (TABLE 140.6-C)
  - Tailored method (TABLE 140.6-D through G)

Calculation of Allowed Lighting Power

§140.6(c)

- **Complete Building Method**
  - TABLE 140.6-B lists building types and corresponding LPD
  - Single LPD for entire building

TABLE 140.6-B COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES

TYPE OF BUILDING	ALLOWED LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)
Auditorium Building	1.5
Classroom Building	1.1
Commercial and Industrial Storage Building	0.6
Convention Center Building	1.2
Financial Institution Building	1.1
General Commercial Building/Industrial Work Building	1.0
Grocery Store Building	1.5
Library Building	1.3
Medical Building/Clinic Building	1.1
Office Building	0.8
Parking Garage Building	0.2
Religious Facility Building	1.6
Restaurant Building	1.2
School Building	1.0
Theater Building	1.3
All others buildings	0.6

Calculation of Allowed Lighting Power

§140.6(c)

- **Area Category Method**
  - TABLE 140.6-C lists function areas and corresponding LPD
  - Each area calculated separately
  - Sum allowed lighting power for all areas

TABLE 140.6-C AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES (WATTS/FT²)

PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER (W/ft²)	PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER (W/ft²)
Auditorium Area		1.5 [3]	Library Area	Reading areas	1.2 [3]
Auto Repair Area		0.9 [2]		Stack areas	1.5 [3]
Beauty Salon Area		1.7	Lobby Area	Hotel lobby	1.1 [3]
Civic Meeting Place Area		1.3 [3]		Main entry lobby	1.5 [3]
Classroom, Lecture, Training, Vocational Areas		1.2 [5]	Locker/Dressing Room		0.8
Commercial and Industrial Storage Areas (conditioned and unconditioned)		0.6	Lounge Area		1.1 [3]
Commercial and Industrial Storage Areas (refrigerated)		0.7	Malls and Atria		1.2 [3]
Convention, Conference, Multipurpose and Meeting Center Areas		1.4 [3]	Medical and Clinical Care Area		1.2
Corridor, Restroom, Stair, and Support Areas		0.6	Office Area	> 250 square feet	0.75
Dining Area		1.1 [3]		≤ 250 square feet	1.0
Electrical, Mechanical, Telephone Rooms		0.7 [2]	Parking Garage Area	Parking Area	0.14
Exercise Center, Gymnasium Areas		1.0		Dedicated Ramps	0.3
Exhibit, Museum Areas		2.0		Daylight Adaptation Zones [9]	0.6
Financial Transaction Area		1.2 [3]	Religious Worship Area		1.5 [3]
General Commercial and Industrial Work Areas	Low bay	0.9 [2]	Retail Merchandise Sales, Wholesale Showroom Areas		1.2 [6 and 7]
	High bay	1.0 [2]			
	Precision	1.2 [4]	Theater Area	Motion picture	0.9 [3]
Grocery Sales Area		1.2 [6 and 7]		Performance	1.4 [3]

Calculation of Allowed Lighting Power
§140.6(c)

- **Tailored Method:**
  - TABLE 140.6-D lists function areas and target illumination levels
  - Calculates general lighting power allowance
  - Provides additional allowance for specialized lighting
    - Wall display
    - Floor display
    - Ornamental

Calculation of Allowed Lighting Power

§140.6(c)

- **Tailored Method Calculation:**
  - LPD of the space dependent on Room Cavity Ratio and target illumination level
  - Table 140.6-F, Room Cavity Ratio equations

$$RCR = \frac{5 \times H \times (L + W)}{L \times W} \qquad RCR = \frac{2.5 \times H \times P}{A}$$

  - Table 140.6-G, Tailored Method LPDs

Calculation of Allowed Lighting Power

§140.6(c)

- **Tailored & Area Category Method can be used together in a building. Each space must use one or the other.**
  - Tailored method task lighting cannot be traded off, only general lighting
- **If Complete Building Method is used, Tailored & Area Category cannot be used.**

Power Adjustment Factors (PAF)

§140.6(a)2

- **Allows for reduction of lighting power**
  - ➢ Installing controls beyond mandatory req.

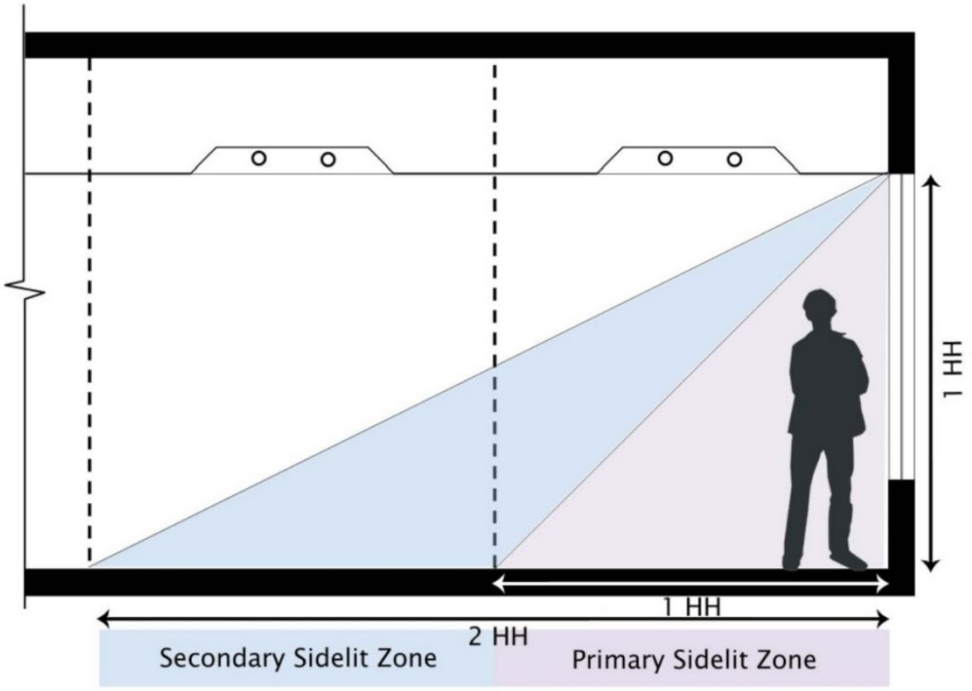
TABLE 140.6-A LIGHTING POWER DENSITY ADJUSTMENT FACTORS (PAF)

TYPE OF CONTROL		TYPE OF AREA		FACTOR
a. To qualify for any of the Power Adjustment Factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2 b. Only one PAF may be used for each qualifying luminaire unless combined below. c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF				
1. Partial-ON Occupant Sensing Control		Any area ≤ 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, conference or waiting room.		0.20
2. Occupant Sensing Controls in Large Open Plan Offices		In open plan offices > 250 square feet: One sensor controlling an area that is:	No larger than 125 square feet	0.40
			From 126 to 250 square feet	0.30
			From 251 to 500 square feet	0.20
3. Dimming System	Manual Dimming	Hotels/motels, restaurants, auditoriums, theaters		0.10
	Multiscene Programmable			0.20
4. Demand Responsive Control		All building types less than 10,000 square feet. Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF		0.05
5. Combined Manual Dimming plus Partial-ON Occupant Sensing Control		Any area ≤ 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, conference or waiting room		0.25

Daylight Controls in Secondary Zones

§140.6(d)

- **Secondary Daylit Zones**
  - Meet req. of §130.1(d)2
  - Separately controlled
  - Shown on the plans
- **Daylight control in Secondary Daylit Zones can be traded off**



Questions on Prescriptive Req.?

Let's Discuss Lighting Controls Acceptance Testing

Acceptance Testing

§130.4

- Acceptance Testing introduced in 2005
- 2013 Standards require certified Acceptance Test Technicians (ATTs) for lighting controls
- ATTs certified through CEC approved ATTCPs

Acceptance Testing

§130.4

- **Two providers certified (as of 6/30/2015)**
  - National Lighting Contractors Association of America (NLCAA)
  - California Advanced Lighting Controls Training Program (CALCTP)
- **More information:**
  - http://www.energy.ca.gov/title24/attcp/

Acceptance Testing
§130.4

- **Acceptance testing always required when lighting controls are installed**
  - New Construction
  - Additions
  - Alterations
- **Acceptance testing required if building is under 10,000 ft^2?**
  - YES

Acceptance Testing

§130.4

- **Verify that applicable Certificate of Acceptance (NRCA) forms are specified/completed.**
- **Verify that ATT is certified by an approved provider:**
  - NLCAA
  - CALCTP
- **List of certified ATTs can be found on each providers respective websites**

Acceptance Testing

§130.4

- **CALCTP and NLCAA have each developed Certificate of Acceptance documentation.**
- **These "alternative" forms have been approved by the Executive Director of the Energy Commission**
  - Will have CALCTP or NLCAA logo on the form
  - Will look similar to CEC form with the same content and informational order

Acceptance Testing

§130.4

- **Certificate of Acceptance Forms:**
  - NRCA-LTI-02 (Lighting Controls Acceptance)
  - NRCA-LTI-03 (Automatic Daylight Controls)
  - NRCA-LTI-04 (Demand Responsive Controls)
  - NRCA-LTO-02 (Outdoor Lighting Controls)

In Summary

- Acceptance testing is required for indoor/outdoor lighting controls
- When applicable, acceptance tests must be specified on the NRCC-LTI-01 form at permit
- Field technician must report results of acceptance testing on respective NRCA form at final inspection
- Field technicians performing testing for indoor/outdoor lighting must be a certified Acceptance Test Technician

Questions on Acceptance Testing?

Let's Discuss Lighting Alterations

Additions and Alterations

- **Additions**
  - same requirements as a newly constructed building
- **Lighting alterations**
  - certain control requirements based on project scope
- **Acceptance Testing required**

Lighting Alterations

- **Three types of lighting alterations:**
  - Lighting system alterations (§141.0(b)2Iii)
  - Luminaire modification-in-place (§141.0(b)2Iiii)
  - Lighting wiring alterations (§141.0(b)2Iiv)
- **Let's discuss each type**

Lighting System Alterations

§141.0(b)2Iii

- **Lighting System Alterations:**
  - Existing lighting system modified; or
  - Luminaires replaced; or
  - Luminaires disconnected from the circuit, removed and reinstalled, whether in the same location or installed elsewhere (i.e. relocated)
- **Only triggered if new luminaires are added or existing luminaires are altered.**

Lighting System Alterations

§141.0(b)2Iii

- **Lighting system alterations meet req. in TABLE 141.0-E**
- **Four Scenarios:**
  - < 10% luminaires affected
  - ≥ 10% luminaires affected, and LPD ≤ 85% of allowed
  - ≥ 10% luminaires affected, and LPD > 85% of allowed
  - Change in area, space type, increase in LPD

LPD stands for Lighting Power Density (Watts/ft^2)

Lighting System Alterations

§141.0(b)2Iii

- **< 10% of luminaires affected in enclosed space**
  - No Requirement
  - Allows for repairs without triggering code.

- **Let's look at TABLE 141.0-E**

Lighting System Alterations

§141.0(b)2Iii

TABLE 141.0-E Requirements for Luminaire Alterations

Quantity of existing affected luminaires per Enclosed Space [1]	Resulting Lighting Power for Each Enclosed Space	Applicable Mandatory Control Provisions for Each Enclosed Space	Multi-level Lighting Control Requirements for Each Altered Luminaire
Alterations that do not change the area of the enclosed space or the space type			
Sum total < 10% of existing luminaires	Existing lighting power is permitted	Existing provisions are permitted	Existing controls are permitted
Sum total ≥ 10% of existing luminaires	≤ 85% of allowed lighting power per Section 140.6 Area Category Method	§130.1(a), (c)	Two level lighting control [2] or §130.1(b)
	> 85% of allowed lighting power per Section 140.6 Area Category Method	§130.1(a), (c), (d) [3]	§130.1(b)
Alterations that change the area of the enclosed space or the space type or increase the lighting power in the enclosed space			
Any number	Comply with Section 140.6	§130.0(d) [3] §130.1(a), (c), (d) [3], (e)	§130.1(b)

1. Affected luminaires include any luminaire that is changed, replaced, removed, relocated; or, connected to, altered or revised wiring, except as permitted by EXCEPTIONS 1 and 2 to Section 141.0(b)**2Iii:**
2. Two level lighting control shall have at least one control step between 30 percent and 70 percent of design lighting power in a manner providing reasonably uniform illuminations
3. Daylight controls in accordance with Section 130.0(d) are required only for luminaires that are altered.

Lighting System Alterations

§141.0(b)2Iii

- **≥ 10% of luminaires affected in the enclosed space. Req. controls (depending on LPD):**

  - Area controls
  - Shutoff controls
  - Multi-level control*
  - Daylight Control*

*Multi-level and Daylight control apply to altered luminaires only

Lighting System Alterations

§141.0(b)2Iii

TABLE 141.0-E Requirements for Luminaire Alterations

Quantity of existing affected luminaires per Enclosed Space [1]	Resulting Lighting Power for Each Enclosed Space	Applicable Mandatory Control Provisions for Each Enclosed Space	Multi-level Lighting Control Requirements for Each Altered Luminaire
Alterations that do not change the area of the enclosed space or the space type			
Sum total < 10% of existing luminaires	Existing lighting power is permitted	Existing provisions are permitted	Existing controls are permitted
Sum total ≥ 10% of existing luminaires	≤ 85% of allowed lighting power per Section 140.6 Area Category Method	§130.1(a), (c)	Two level lighting control [2] or §130.1(b)
	> 85% of allowed lighting power per Section 140.6 Area Category Method	§130.1(a), (c), (d) [3]	§130.1(b)
Alterations that change the area of the enclosed space or the space type or increase the lighting power in the enclosed space			
Any number	Comply with Section 140.6	§130.0(d) [3] §130.1(a), (c), (d) [3], (e)	§130.1(b)

1. Affected luminaires include any luminaire that is changed, replaced, removed, relocated; or, connected to, altered or revised wiring, except as permitted by EXCEPTIONS 1 and 2 to Section 141.0(b)**2Iii:**
2. Two level lighting control shall have at least one control step between 30 percent and 70 percent of design lighting power in a manner providing reasonably uniform illuminations
3. Daylight controls in accordance with Section 130.0(d) are required only for luminaires that are altered.

Lighting System Alterations

§141.0(b)2Iii

- **Alterations that change area of enclosed space, change space type, or increase lighting power, and that alter luminaires**
  - Area controls
  - Shutoff controls
  - Multi-level control*
  - Daylight Control*
  - Demand Response Control

DR control required only if altered area is greater than 10,000 ft^2

*Multi-level and Daylight control applies to the altered luminaires only

Luminaire Modification-in-Place

§141.0(b)2Iiii

- **Luminaire Modifications-in-Place (LMIP):**
  - Replacing both lamps and ballasts
  - Modifying internals of the luminaire
  - Changing optical system
  - One for one replacement of luminaires
- **LMIP shall not be part of general remodeling or renovation, or changes to wiring to the lighting system.**

Luminaire Modification-in-Place

§141.0(b)2Iiii

- **LMIP triggered in the enclosed space only if:**
  - ≥ 40 luminaires in a building space are MIP; and
  - ≥ 10% of the luminaires in the enclosed space

TABLE 5- 13 Thresholds for Luminaire-Modifications-in-Place requirements

Number of Luminaire-Modifications-in-Place		Is compliance required for that enclosed space?
Per annum per building space	In an enclosed space	
< 40 in number	< 10%	No
< 40 in number	≥ 10%	No
≥ 40 in number	< 10%	No
≥ 40 in number	≥ 10%	Yes

Luminaire Modification-in-Place

§141.0(b)2Iiii

- **LMIP meet req. of TABLE 141.0-F**
- **Req. controls (depending on LPD):**
  - Area controls
  - Shutoff controls
  - Multi-level control*
  - Daylight Control*
- **Let's look at TABLE 141.0-F**

*Multi-level and Daylight control applies to the altered luminaires only

Luminaire Modification-in-Place

§141.0(b)2Iiii

TABLE 141.0-F-Requirements for Luminaire Modifications-in-Place

For compliance with this Table, building space is defined as any of the following:

1. A complete single story building
2. A complete floor of a multifloor building
3. The entire space in a building of a single tenant under a single lease
4. All of the common, not leasable space in single building

Quantity of affected luminaires per Building Space per annum	**Resulting Lighting Power per Each Enclosed Space Where ≥ 10% of Existing Luminaires are Luminaire Modifications-in-Place**	**Applicable mandatory control provisions for each enclosed space [1]**	**Applicable multi-level lighting control requirements for each modified luminaire [2]**
Sum total < 40 Luminaire Modifications-in-Place	Existing lighting power is permitted	Existing provisions are permitted	Existing controls are permitted
Sum total ≥ 40 Luminaire Modifications-in-Place	≤ 85% of allowed lighting power per Section 140.6 Area Category Method	§130.1(a), (c)	Two level lighting control [3] Or §130.1(b)
	> 85% of allowed lighting power per Section 140.6 Area Category Method	§130.0(d) [4] §130.1(a), (c), (d) [4]	§130.1(b)

Lighting Wiring Alteration

§141.0(b)2Iiv

- **Lighting Wiring Alterations:**
  - Adding a circuit feeding luminaires
  - Modifying/relocating wiring to luminaires
  - Replacing wiring between switch or panelboard and luminaires
  - Replacing or installing new panelboard feeding lighting systems
- **Must meet *applicable* requirements of §110.9, §130.1, and §130.4**

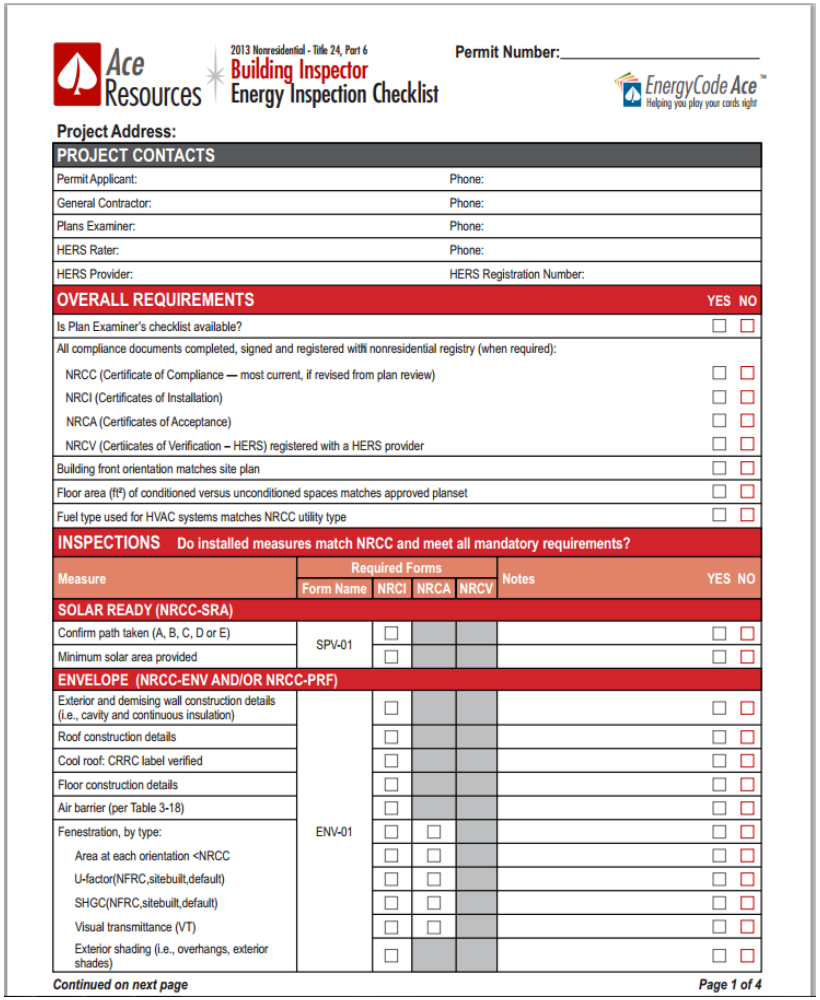
Questions on Lighting Alterations?

What does a Field Inspector do?

- **Verify installed lighting power meets the Certificate of Compliance**
- **Verify mandatory lighting controls are installed**
- **Verify applicable Acceptance & Installation Forms are completed**

Simplify Inspections with Inspection Checklist

- **Inspection Checklist by EnergyCodeAce**
  - Used with the Plans Review checklist
  - Specifies which forms to verify
  - Electronic PDF to be completed in the field
  - http://energycodeace.com/content/resources-checklists/



Ace Resources

2013 Nonresidential - Title 24, Part 6
Building Inspector Energy Inspection Checklist

Permit Number:_____

EnergyCode Ace
Helping you play your cards right

Project Address:

PROJECT CONTACTS	
Permit Applicant:	Phone:
General Contractor:	Phone:
Plans Examiner:	Phone:
HERS Rater:	Phone:
HERS Provider:	HERS Registration Number:

OVERALL REQUIREMENTS	YES	NO
Is Plan Examiner's checklist available?	☐	☐
All compliance documents completed, signed and registered with nonresidential registry (when required):		
NRCC (Certificate of Compliance — most current, if revised from plan review)	☐	☐
NRCI (Certificates of Installation)	☐	☐
NRCA (Certificates of Acceptance)	☐	☐
NRCV (Certiicates of Verification – HERS) registered with a HERS provider	☐	☐
Building front orientation matches site plan	☐	☐
Floor area (ft²) of conditioned versus unconditioned spaces matches approved planset	☐	☐
Fuel type used for HVAC systems matches NRCC utility type	☐	☐

INSPECTIONS Do installed measures match NRCC and meet all mandatory requirements?

Measure	Required Forms: Form Name	NRCI	NRCA	NRCV	Notes	YES	NO
SOLAR READY (NRCC-SRA)							
Confirm path taken (A, B, C, D or E)	SPV-01	☐				☐	☐
Minimum solar area provided		☐				☐	☐
ENVELOPE (NRCC-ENV AND/OR NRCC-PRF)							
Exterior and demising wall construction details (i.e., cavity and continuous insulation)	ENV-01	☐				☐	☐
Roof construction details		☐				☐	☐
Cool roof: CRRC label verified		☐				☐	☐
Floor construction details		☐				☐	☐
Air barrier (per Table 3-18)		☐				☐	☐
Fenestration, by type:		☐	☐			☐	☐
Area at each orientation <NRCC		☐	☐			☐	☐
U-factor(NFRC,sitebuilt,default)		☐	☐			☐	☐
SHGC(NFRC,sitebuilt,default)		☐	☐			☐	☐
Visual transmittance (VT)		☐	☐			☐	☐
Exterior shading (i.e., overhangs, exterior shades)		☐				☐	☐

Continued on next page

§140.6 and the Field Inspector

- **At Rough Frame verify**
  - Installed watts/ft^2
  - Shall not exceed values on NRCC-LTI-01 form
- **If PAF controls credits were used**
  - Verify controls are installed
  - Simplify with NRCI-LTI-05

§140.6 and the Field Inspector *cont.*

- **All req. NRCI-LTI forms must be verified**
  - Refer to NRCC-LTI-01 (use as checklist)
  - Completed by installing contractor
- **All req. NRCA-LTI forms must be verified**
  - Refer to NRCC-LTI-01 (use as checklist)
  - Must be performed by Certified ATT

Certificate of Installation

- **Completed by the installing contractor for:**
  - EMCS or lighting control system (NRCI-LTI-02)
  - Track lighting current limiter or supplementary overcurrent protection panel (NRCI-LTI-03)
  - Two interlocked lighting systems (NRCI-LTI-04)
  - Power Adjustment Factors (NRCI-LTI-05)
  - Videoconference studio lighting (NRCI-LTI-06)

Final - Indoor Lighting

- **Controls**

Verify (each enclosed area):

Area controls

- ON/OFF controls

Shut-off controls

- Occupancy sensor, automatic time switch

Multi-level controls

- Dimming, Dimming Uniformity

NRCA-LTI-02 form

- *Acceptance test to verify lighting controls (simplify with this form)*

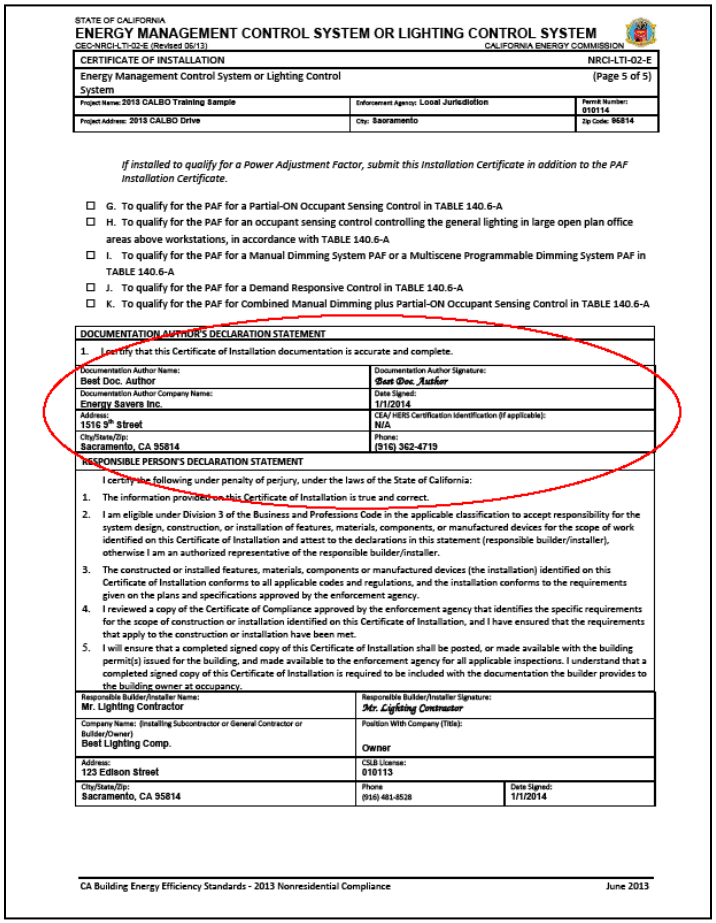
Final - Indoor Lighting *cont.*

- **Daylighting controls**
  - Dimming, photo sensor, etc. *(separate from general lighting)*
- **Demand Response Controls**
  - Reduction of lighting power by 15%
  - Req. when greater than 10,000 ft^2

NRCA-LTI-03 & 04

- *Acceptance test to verify daylighting & DR controls (simplify with these forms)*

§10-103 and the Field Inspector



STATE OF CALIFORNIA
ENERGY MANAGEMENT CONTROL SYSTEM OR LIGHTING CONTROL SYSTEM
CEC-NRCI-LTI-02-E (Revised 05/13) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		NRCI-LTI-02-E
Energy Management Control System or Lighting Control System		(Page 5 of 5)
Project Name: 2013 CALBO Training Sample	Enforcement Agency: Local Jurisdiction	Permit Number: 010114
Project Address: 2013 CALBO Drive	City: Sacramento	Zip Code: 95814

If installed to qualify for a Power Adjustment Factor, submit this Installation Certificate in addition to the PAF Installation Certificate.

- ☐ G. To qualify for the PAF for a Partial-ON Occupant Sensing Control in TABLE 140.6-A
- ☐ H. To qualify for the PAF for an occupant sensing control controlling the general lighting in large open plan office areas above workstations, in accordance with TABLE 140.6-A
- ☐ I. To qualify for the PAF for a Manual Dimming System PAF or a Multiscene Programmable Dimming System PAF in TABLE 140.6-A
- ☐ J. To qualify for the PAF for a Demand Responsive Control in TABLE 140.6-A
- ☐ K. To qualify for the PAF for Combined Manual Dimming plus Partial-ON Occupant Sensing Control in TABLE 140.6-A

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT

1. I certify that this Certificate of Installation documentation is accurate and complete.

Documentation Author Name:	Documentation Author Signature:
Best Doc. Author	*Best Doc. Author*
Documentation Author Company Name:	Date Signed:
Energy Savers Inc.	1/1/2014
Address: 1516 9th Street	CEA/ HERS Certification Identification (If applicable): N/A
City/State/Zip: Sacramento, CA 95814	Phone: (916) 362-4719

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Installation is true and correct.
2. I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction, or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Installation and attest to the declarations in this statement (responsible builder/installer), otherwise I am an authorized representative of the responsible builder/installer.
3. The constructed or installed features, materials, components or manufactured devices (the installation) identified on this Certificate of Installation conforms to all applicable codes and regulations, and the installation conforms to the requirements given on the plans and specifications approved by the enforcement agency.
4. I reviewed a copy of the Certificate of Compliance approved by the enforcement agency that identifies the specific requirements for the scope of construction or installation identified on this Certificate of Installation, and I have ensured that the requirements that apply to the construction or installation have been met.
5. I will ensure that a completed signed copy of this Certificate of Installation shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Installation is required to be included with the documentation the builder provides to the building owner at occupancy.

Responsible Builder/Installer Name:	Responsible Builder/Installer Signature:	
Mr. Lighting Contractor	*Mr. Lighting Contractor*	
Company Name: (Installing Subcontractor or General Contractor or Builder/Owner) Best Lighting Comp.	Position With Company (Title): Owner	
Address: 123 Edison Street	CSLB License: 010113	
City/State/Zip: Sacramento, CA 95814	Phone (916) 481-8528	Date Signed: 1/1/2014

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance June 2013

- **At Final, verify signature on Certificate of:**
  - Installation (NRCI)
  - Acceptance (NRCA)
- **Verify NRCA-LTI forms are signed by Certified Acceptance Test Technician**

QUESTIONS…

Resources - Blueprint

- Published every other month
- Clarifications on frequently asked questions
- Receive by e-mail
- http://www.energy.ca.gov/efficiency/blueprint/

BLUEPRINT — CALIFORNIA ENERGY COMMISSION • PAGE 1

CALIFORNIA ENERGY COMMISSION

BLUEPRINT

EFFICIENCY DIVISION

Issue 107 January - February 2015

In This Issue

- Cool Roofs & Condensation
- QII Compliance Credit for Insulated Headers
- Approved Acceptance Test Technician Certification Providers for Lighting Controls
- Free Training Opportunities
- Q&A
  - Commissioning
  - Nonresidential Economizers
  - Residential Reroof Projects
  - Luminaire Modifications-in-Place

Cool Roofs & Condensation

A cool roof is a roofing material with high thermal emittance and high solar reflectance, or low thermal emittance and exceptionally high solar reflectance that reduces heat gain through the roof. Because cool roofs gain and retain less heat than traditional roofs, less heat is transferred through the envelope into the building's interior. By lowering internal temperatures, cool roofs reduce occupant demand for air conditioning, allowing for building cooling cost savings.

The temperature of the cool roof is reduced to such an extent that moisture no longer evaporates as it would with a traditional roof. When cool roofs are not installed properly, moisture condenses and becomes trapped within the roofing materials. The trapped moisture can lead to mold growth and damage to the roofing materials or supporting elements.

To prevent the trapping of moist air, it is essential to follow proper air sealing procedures as outlined in Section 110.7 of the 2013 Building Energy Efficiency Standards (Energy Standards). Proper installation may require the installation of: air barriers, vapor barriers, insulation above the roof deck, and additional ventilation.

For more information on cool roofs, please review the U.S. Department of Energy's *Energy Saver* article "Cool Roofs" at: http://www.energy.gov/energysaver/articles/cool-roofs.

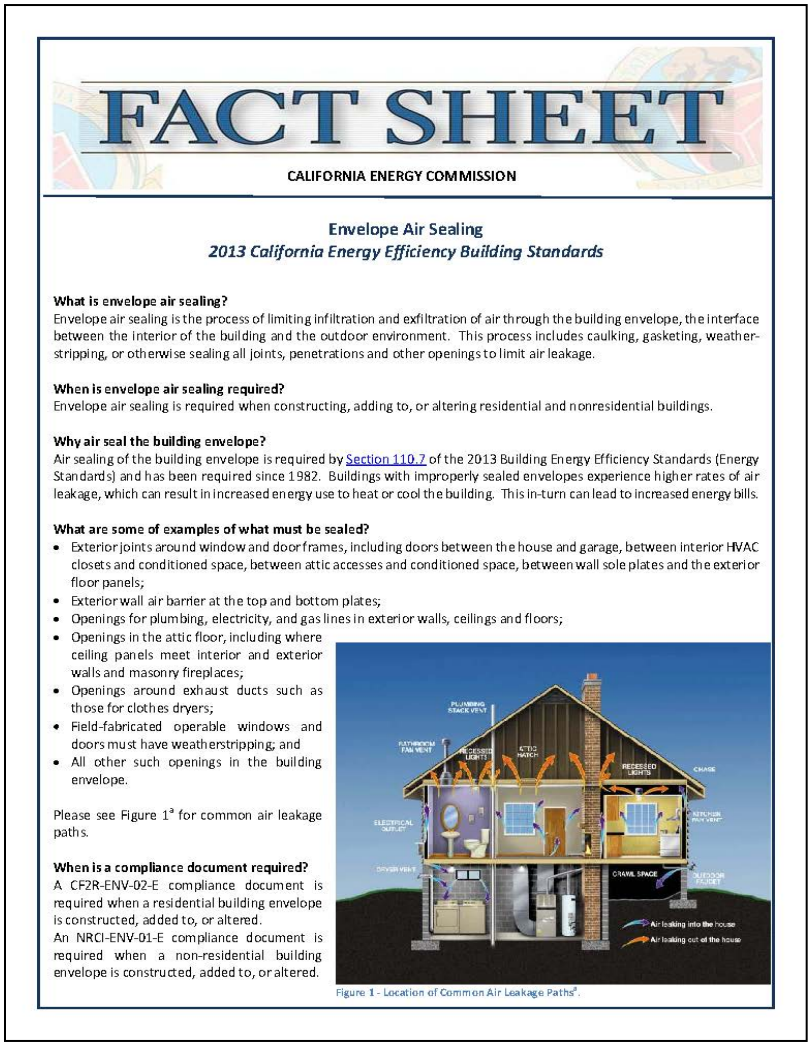
Quality Insulation Installation (QII) Compliance Credit for Insulated Headers

The 2013 Energy Standards provide Quality Insulation Installation (QII) compliance credit for R-2 insulated headers as indicated in Section RA3.5.6.2.9 of the 2013 Reference Residential Appendices (RA). Insulation or wood must fill the cavities, leaving no air gaps in or around the header. To obtain QII credit, use compliance document CF2R-ENV-21-H. Compliance with the R-2 insulated header requirement is verified in Section C, number 13 of this compliance document.

Three options meet the R-2 insulated header requirement:

1. Two-member header with insulation in between. The header and insulation must fill the wall cavity. Example: a 2x4 wall with two 2x nominal headers, or a 2x6 wall with a 4x nominal header and a 2x nominal header. Insulation is required to fill the wall cavity and must be installed between the headers.

Resources - Fact Sheets



FACT SHEET

CALIFORNIA ENERGY COMMISSION

Envelope Air Sealing

2013 California Energy Efficiency Building Standards

What is envelope air sealing?
Envelope air sealing is the process of limiting infiltration and exfiltration of air through the building envelope, the interface between the interior of the building and the outdoor environment. This process includes caulking, gasketing, weather-stripping, or otherwise sealing all joints, penetrations and other openings to limit air leakage.

When is envelope air sealing required?
Envelope air sealing is required when constructing, adding to, or altering residential and nonresidential buildings.

Why air seal the building envelope?
Air sealing of the building envelope is required by Section 110.7 of the 2013 Building Energy Efficiency Standards (Energy Standards) and has been required since 1982. Buildings with improperly sealed envelopes experience higher rates of air leakage, which can result in increased energy use to heat or cool the building. This in-turn can lead to increased energy bills.

What are some of examples of what must be sealed?

- Exterior joints around window and door frames, including doors between the house and garage, between interior HVAC closets and conditioned space, between attic accesses and conditioned space, between wall sole plates and the exterior floor panels;
- Exterior wall air barrier at the top and bottom plates;
- Openings for plumbing, electricity, and gas lines in exterior walls, ceilings and floors;
- Openings in the attic floor, including where ceiling panels meet interior and exterior walls and masonry fireplaces;
- Openings around exhaust ducts such as those for clothes dryers;
- Field-fabricated operable windows and doors must have weatherstripping; and
- All other such openings in the building envelope.

Please see Figure 1[a] for common air leakage paths.

When is a compliance document required?
A CF2R-ENV-02-E compliance document is required when a residential building envelope is constructed, added to, or altered.
An NRCI-ENV-01-E compliance document is required when a non-residential building envelope is constructed, added to, or altered.

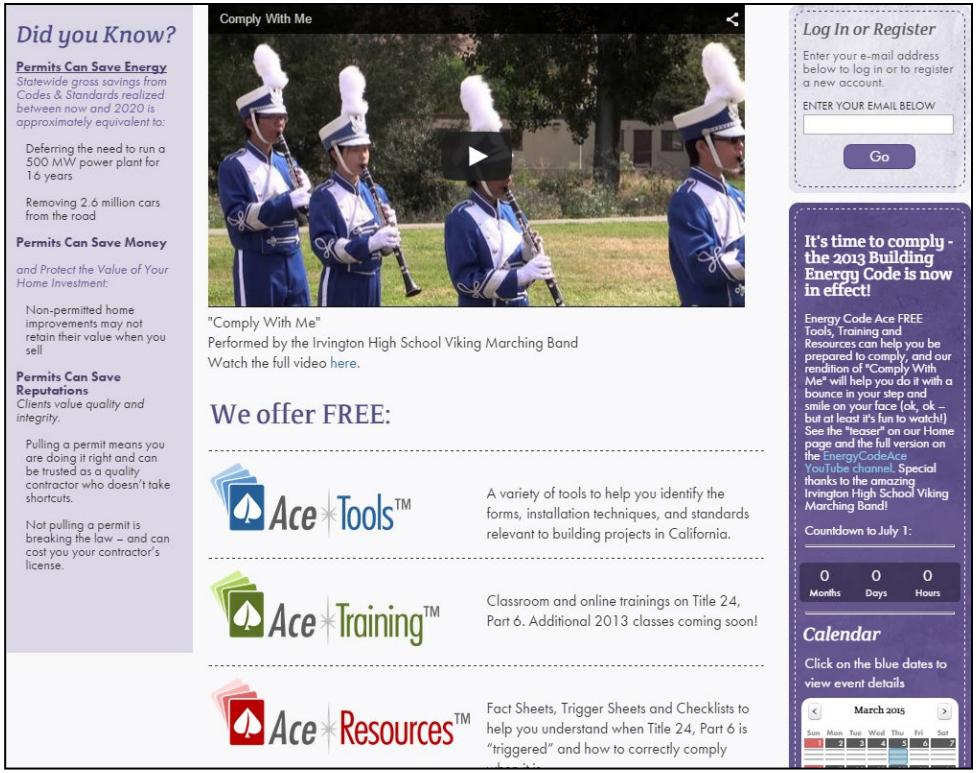
Figure 1 - Location of Common Air Leakage Paths[a].

- 5 published to date
- Detailed clarifications on specific topic/requirements
- Receive by e-mail (listserver)
- http://www.energy.ca.gov/efficiency/factsheets/

Resources - Training

- Provided by Utilities
- Free of charge
- Can request for training in your region/area
- CEC training
- http://www.energy.ca.gov/title24/training/

Resources - Energy Code Ace



- Forms tools
- Free training (in person and online)
- Checklists, Trigger Sheets for building dept.
- http://www.energycodeace.com/content/home/

Resources - Hotline

- Toll-free in California
- Open Monday through Friday
  - 8:00 am to noon, and
    1:00 pm to 4:30 pm
- Call at:
  - 1-800-772-3300 (In CA)
  - (916) 654-5106 (Outside CA)
- OR, e-mail at: Title24@energy.ca.gov

Resources - Listservers

- Main conduit for communicating with stakeholders
- Sign up at:
  - http://www.energy.ca.gov/listservers/
- Subscribe to the following Efficiency Lists:
  - Building Standards
  - Blueprint
  - Efficiency
- Respond to confirmation e-mail within 48 hours