2016 CALBO Education Week

2016 California Energy Code: Nonresidential Lighting Requirements

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President/Executive Board of Directors, CALBO
Chair, CA Building Standards Commission PEME CAC

AGENDA

Class	8:00 am - **11:15 am**
Break	~ 9:30 am - 9:45 am
Certificates/ Evaluation	Conclusion of Class

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

CALBO – CALIFORNIA TRAINING INSTITUTE

2016 CALIFORNIA ENERGY CODE
NON-RESIDENTIAL LIGHTING REQUIREMENTS

- *Non-Gov't Jurisdiction*
- *Private Consulting*

- *Building Department*
- *Non-Building & Safety*

LIGHTING COMPLIANCE
NON-RESIDENTIAL OCCUPANCIES

TOPICS

1. Introduction
2. *What's New* - Lighting & Electrical
3. Mandatory Measures
4. Outdoor Lighting, Signs, Solar Ready
5. Performance Method
6. Prescriptive Method
7. Electrical Systems
8. Additions & Alterations
9. Example

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High rise residential 4 stories or more

Title-24, Part 6 Energy Conservation

Applicable Discussion: Non-Residential, High-Rise Residential

Occupancy Groups (*A, B, E, F, H, M, R, S, U*)

§ 110.9	Lighting Control Devices, Ballasts, Luminaires
§ 110.10	Mandatory Solar Ready Requirements
§ 110.11	Mandatory Electrical Power Distribution Systems (NEW)
§ 130.0	Lighting Controls and Equipment
§ 130.1	Indoor Lighting Controls Mandatory
§ 130.2	Outdoor Lighting and Equipment
§ 130.3	Sign Lighting Controls
§ 130.4	Lighting Control Acceptance & Installation Cert
§ 130.5	Electrical Power Distribution Systems
§ 140.1	Performance Approach: Energy Budgets
§ 140.6	Prescriptive Requirements Indoor Lighting
§ 140.7	Outdoor Lighting Requirements
§ 140.8	Signs (Indoor, Outdoor) Requirements
§ 141.0	Non-Res Alterations, Additions, Repairs

INTRODUCTION

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ADMINISTRATIVE REGULATIONS OF THE CEC

§ 10-103(a)2.A. Building Permit Application

For all newly constructed buildings, additions, alterations, or repairs regulated by Part 6 the applicant shall submit the applicable Certificate(s) of Compliance to the enforcement agency for approval.

The certificate(s) shall conform to the requirements of Section 10-103(a)1, and shall be approved by the local enforcement agency . . . by stamp or authorized signature ***prior to issuance of a building permit.***

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ADMINISTRATIVE REGULATIONS OF THE CEC

§ 10-103(d) Enforcement Agency Requirements

1. Permits.

An enforcement agency *shall not issue a building permit* for any construction unless the enforcement agency determines in writing that the construction is designed to comply with the requirements of Part 6 that are in effect on the date the building permit was applied for.

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ADMINISTRATIVE REGULATIONS OF THE CEC

§ 10-103(d) Enforcement Agency Requirements

2. Inspection.

The enforcement agency ***shall inspect*** newly constructed buildings and additions, and alteration to existing buildings to determine whether the construction or installation is consistent with the agency's approved plan and specifications, and complies with Part 6.

Final certificate of occupancy ***shall not be issued*** until such consistency and compliance is verified.

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ADMINISTRATIVE REGULATIONS OF THE CEC

§ 10-103 Permit, Certificate, Informational and Enforcement Requirements

(a) Documentation. The following documentation is required to demonstrate compliance with Part 6.

1.	*Certificate of Compliance*	*NRCC*
2.	*Building Permit Application*	
3.	*Certificate of Installation*	*NRCI*
4.	*Certificate of Acceptance*	*NRCA*
5.	*Certificate of Field Verification*	*NRCV*

Exception: <1,000 Square Feet and Occupant Load <=49
Statement of Compliance from Licensed Engineer or Architect

So to the registry to verify certificate of acceptance.

WHAT'S NEW
LIGHTING & ELECTRICAL

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California Energy Commission
2016 Building Energy Efficiency Standards
What's New for Nonresidential

Lighting

1. Clarification and simplification of existing language; removing exceptions no longer relevant (§ 130.0 through § 130.5 and § 140.6 through § 140.8).
2. Reductions to lighting power density (LPD) values in TABLES 140.6-B, 140.6-C, and 140.6-G.
3. Removal/addition of power adjustment factors (PAFs) (§ 140.6(a)2).
4. Significant reductions in outdoor lighting power allowances (TABLE 140.7-A).
5. Clarification and streamlining of alteration requirements, including addition of a new compliance path that allows compliance by reducing the existing lighting power. For indoor lighting, this path foregoes bi-level control requirements but is otherwise identical to the 85 percent or less of lighting power allowance path.

Electrical

1. New definitions of electrical metering, service equipment, plug load, and low voltage dry-type distribution transformer are added to § 100.1.
2. Revisions and clarifications of service electrical metering § 130.5(a), separation of electrical circuits in § 130.5(b), voltage drop in § 130.5(c), and circuit controls in § 130.5(d).

Covered Processes

New mandatory requirements for elevators, escalators and moving walkways (§ 120.6(f) and § 120.6(g)).

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NEW FORMS – 2016 COMPLIANCE FORMS

NRCA – LTI-05-A Institutional Tuning Power Adjustment Factor

NRCA-PRC-12-F Elevator Lighting & Ventilation Controls

NRCA-PRC-13-F Escalator & Moving Walkways Speed Control

NRCC-LTI-06-E Indoor Lighting Existing Conditions

NRCC-LTO-04-E Outdoor Lighting Existing Conditions

NRCC-PRC-12-E Elevator Lighting and Ventilation Controls

NRCC-PRC-13-E Escalator and Moving Walkways Speed Controls

NEW / REVISED DEFINITIONS

ALTERATION is any change to a building's water-heating system, space-conditioning system, lighting system, electrical power distribution system, or envelope that is not an addition.

CIE 13.3 is the International Commission on Illumination document "Method of Measuring and Specifying Colour Rendering Properties of Light Sources"

CIE 15 is the International Commission on Illumination document "Technical Report: Colorimetry"

NEW DEFINITIONS

ELECTRICAL POWER DISTRIBUTION SYSTEMS.
Applies only to Section 130.5:

- *Equipment* ***""NEC""***
- *Plug Load* ---
- *Electrical Metering* ---
- *Low Voltage Dry-Type Distribution Transformer* --- went from 600 volts - 1,000 volts.
- *Service* ***NEC***
- *Service Equipment* ***NEC***

NEW DEFINITIONS

*LIGHTING definitions **NEW**:*

- *Color Rendering Index (CRI)*
- *Correlated Color Temperature (CCT)*
- *Color Light Source*
- *Enclosed Luminaires*
- *Light Emitting Diode (LED)*
- *LED Light Engine*
- *Non-Integrated LED Lamp*
- *Integrated LED Lamp*
- *Luminous Efficacy*
- *Recessed Luminaire*
- *Track Lighting Integral Current Limiter*
- *Track Lighting Supplementary Overcurrent Protection Panel*

NEW DEFINITIONS

LIGHTING CONTROLS definitions NEW:

- *Automatic Scheduling Control*
- *Dimmer, Forward Phase Cut*
- *NEMA SSL 7A ("Phase Cut Dimming for Solid State Lgt)*
- *Shut-Off Controls*

UL 1598 Underwriters Laboratories "Luminaires" 2008

MANDATORY MEASURES

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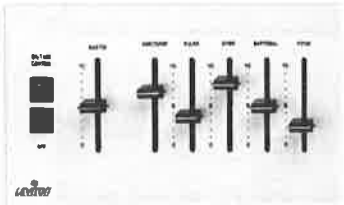
LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 20*

§ 110.9(a)

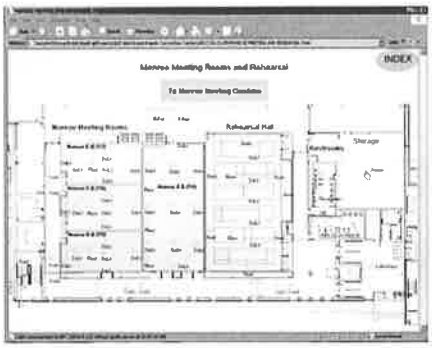
- Lighting Control Devices and Systems



LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 20*

§ 110.9(a)

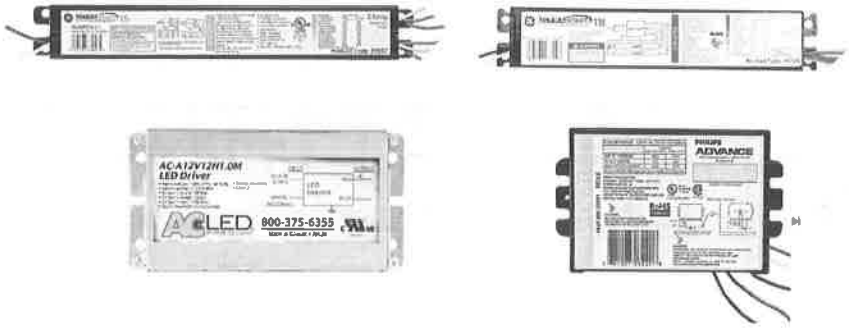
- Lighting Control Devices and Systems



LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 20*

§ 110.9(a)

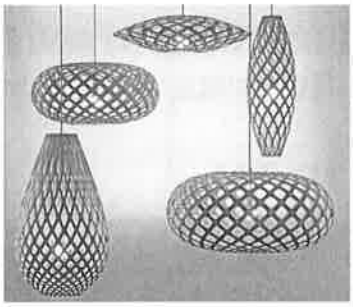
- Ballasts



LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 20*

§ 110.9(a)

- Luminaires



LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 20*

§ 110.9(b)

1. Time-Switch Lighting Controls
   - Automatic Time-Switch Controls
   - Astronomical Time-Switch Controls
   - Multi-Level Astronomical Time-Switch Controls
   - Outdoor Astronomical Time-Switch Controls

LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 20*

§ 110.9(b)

2. Daylighting Controls
   - Automatic Daylight Controls
   - Photo Controls

see these @ skylights for lighting control

LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 20*

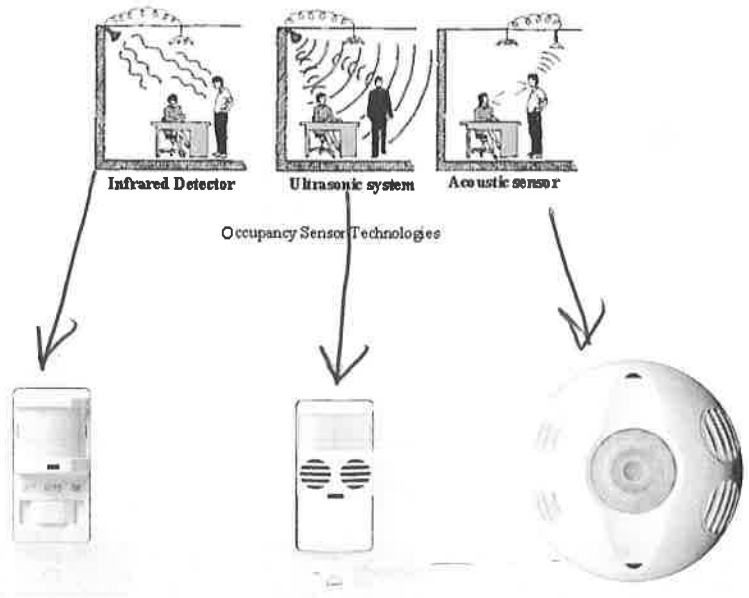
§ 110.9(b)

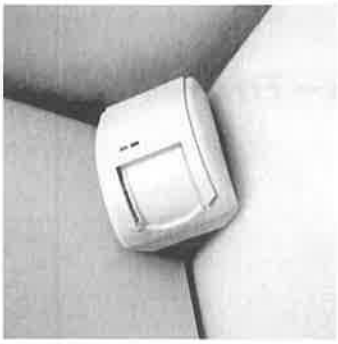
3. Dimmers

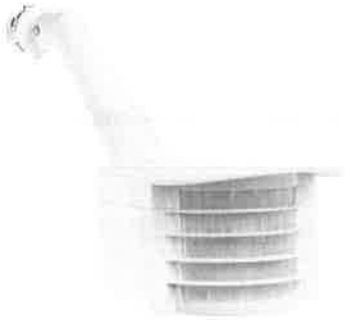
LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 20*

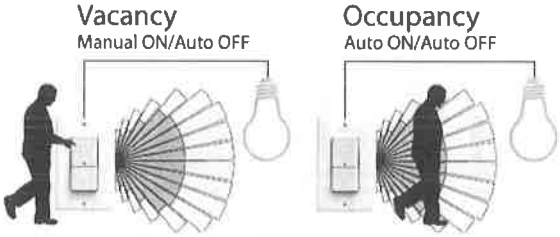
§ 110.9(b)

4. Occupant Sensing Controls
   - Occupant Sensors
   - Motion Sensors
   - Vacancy Sensors
   - Partial-ON Sensors
   - Partial-OFF Sensors
   - All Occupant Sensing Control Types








Vacancy
Manual ON/Auto OFF
Occupancy
Auto ON/Auto OFF

LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 24*

§ 110.9(c) Track Lighting Integral Current Limiter

- Certified CEC
- Installation Requirements 130.4
- Mfg of Current Limiter Same Mfg of Track
- Permanently Attached but Destructive Removal
- Tamper Resistant Fasteners Wiring Compartment
- VA Rating
- Factory Label Warning

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LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 24*

§ 110.9(c) Track Lighting Integral Current Limiter

Electrical Panel marked:
NOTICE: Current limiting devices installed in track lighting integral current limiters connected to this panel shall only be replaced with the same or lower amperage. Adding track or replacement of existing current limiters with higher continuous ampere rating will void the track lighting integral current limiter certification, and will require resubmittal of compliance documentation to the enforcement agency responsible for compliance with the California Title 24, Part Building Energy Efficiency Standards.

LIGHTING CONTROL DEVICES & SYSTEMS, BALLASTS, LUMINAIRES – *TITLE 24*

§ 110.9(d) Track Lighting Supplementary Overcurrent Protection Panel

120

- Only for (Line-Voltage) Track Lighting
- No other lighting or power circuits
- Installed in an electrical room, or adjacent to the supply

Labeled:
"NOTICE: This Panel For Track Lighting Energy Code Compliance Only"

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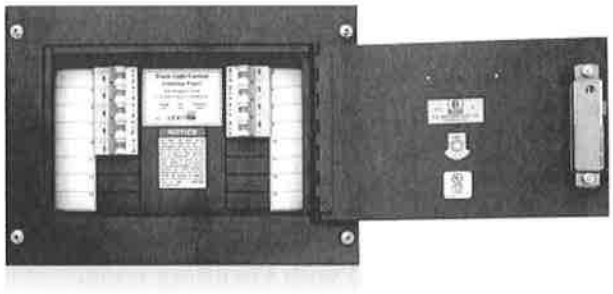

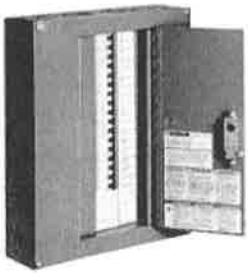

STATE OF CALIFORNIA

TRACK LIGHTING INTEGRAL CURRENT LIMITER OR SUPPLEMENTARY OVERCURRENT PROTECTION PANEL

CEC-NRCI-LTI-03-E (Revised 01/11) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		NRCI-LTI-03-E
Track Lighting Integral Current Limiter or Supplementary Overcurrent Protection Panel		(Page 1 of 4)
Project Name	Administrator Name	Permit Number
Project Address	City	Zip Code

GENERAL INFORMATION				
DATE OF BUILDING PERMIT	PERMIT #			
BUILDING TYPE	☐ Nonresidential	☐ High-Rise Res (Common Area)	☐ Hotel/Motel (Common Area)	
PHASE OF CONSTRUCTION	☐ New Construction	☐ Addition	☐ Alteration	☐ Unconditioned

SCOPE OF RESPONSIBILITY	
Enter the date of approval by enforcement agency of the Certificate of Compliance that provides the specifications for the energy efficiency measures for the scope of responsibility for this Installation Certificate:	Date:
Certified Integral Current Limiters, and Dedicated Supplementary Overcurrent Protection Panels Used to Control Line-Voltage Track Lighting	

§130.4(b) Before a Line-Voltage Track Lighting Integral Current Limiter or Supplementary Overcurrent Protection Panel will be recognized for compliance with the lighting requirements in Part 6 of Title 24, the person who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the construction or installation of features, materials, components, or manufactured devices shall sign and submit this Installation Certificate.

If any of the following requirements fail to comply with any of the Line-Voltage Track Lighting Installation requirements, these methods for determining installed lighting power shall not be used for compliance with the Building Energy Efficiency Standards.

Check all that apply:

PART 1 Type of Line-Voltage Track Lighting Control Installed:

☐ **A. Certified Line-Voltage Track Lighting Integral Current Limiter:**
A Line-Voltage Track Lighting Integral Current Limiter that has been certified to the Energy Commission, and consists of a current limiter integral to the end-feed housing of a manufactured line-voltage track lighting system.

☐ **B. Dedicated Line-Voltage Track Lighting Supplementary Overcurrent Protection Panel:**
A Track Lighting Supplementary Overcurrent Protection Panel is a Panelboard containing Supplementary Overcurrent Protection Devices as defined in Article 100 of the California Electric Code, and used only with line voltage track lighting.

MANDATORY REQUIREMENTS LIGHTING SYSTEMS

Subchapter 4
§ 130.0(b) Functional Areas

➡ 150.0(k)

- High-Rise Residential Dwellings 4 stories or more
- Outdoor Lighting Controls Associated with Dwelling Units
- Hotels/Motels

a podium with 3 stories of residential above does not constitute High-Rise.

MANDATORY LIGHTING CONTROLS

§ 130.1 Indoor Lighting Controls

(a) Area Controls
(b) Multilevel Lighting Controls
(c) Shut-OFF Controls
(d) Automatic Daylighting Controls
(e) Demand Responsive Controls

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MANDATORY LIGHTING CONTROLS

§ 130.1(a) Area Controls

1. Manual ON/OFF
2. Readily Accessible
   - Located in the Same Room or Area
     - *Retail, etc: May see the lights being controlled*
3. Other Controls Allowed but Manual ON/OFF Primary
4. General Lighting Separately Controlled
   - Other Lighting
   - Floor, Wall, Window Displays
   - Track Lighting

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MANDATORY LIGHTING CONTROLS

§ 130.1(b) Multilevel Lighting Controls
(> 100 Sq Ft, > 0.5w/sf)

1. Control Steps: Table 130.1-A

Multilevel Lighting Control *reduces power going to a lighting system in multiple steps.*

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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	Maximum 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	Maximum 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 %	75-85 %	100 %	
Track Lighting	Maximum 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	Maximum 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

MANDATORY LIGHTING CONTROLS

§ 130.1(b) Multilevel Lighting Controls
(> 100 Sq Ft, > 0.5w/sf)

1. Control Steps: Table 130.1-A
2. Must Not Override Area Controls, Automatic Shut-OFF, Demand Response
3. Dimmable Luminaires
   - Manual Dimming
   - Shall be Controlled by a Dimmable Control
   - ON/OFF Functionality

Primary

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MANDATORY LIGHTING CONTROLS

§ 130.1(c) Automatic Shut-OFF Controls

(In addition to Manual ON/OFF & Multilevel Controls)

1. Control When Room is UnOccupied
   - Occupant Sensing
   - Automatic Time-Switch (w/Override, Holiday)
   - Separate Controls, Separate Floors
   - Maximum Control Area: 5,000 Square Feet

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MANDATORY LIGHTING CONTROLS

§ 130.1(c) Automatic Shut-OFF Controls

5. Occupant Sensors REQUIRED to Shut-OFF All Lighting
   - Offices <= 250 Sq Ft
   - Multipurpose Rooms < 1,000 Sq Ft
   - Classrooms Any Size
   - Conference Rooms

Plus

- Multilevel Controls
- Partial ON: 50 to 70% of Controlled Lighting

Or

- Vacancy Sensor: Manual ON – Auto OFFF

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MANDATORY LIGHTING CONTROLS

§ 130.1(c) Automatic Shut-OFF Controls

6. Full or Partial OFF Occupant Sensing: *50% Reduction*
   - Aisles Ways Open Areas Warehouses
   - Each Aisle Separate
   - Corridors and Stairwells

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MANDATORY LIGHTING CONTROLS

§ 130.1(c) Automatic Shut-OFF Controls

verify that this will not effect the egress lighting

7. Partial OFF Occupant Sensing
   - High-Rise Res: Stairwells, Corridors – Common Areas
   - Hotels/Motels: Stairwells, Corridors – Common Areas
   - Parking Garages, Parking Areas, Loading/Unloading
     - Control Step 20% to 50% Lighting; 500W Max

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MANDATORY LIGHTING CONTROLS

§ 130.1(c) Automatic Shut-OFF Controls

8. Hotel/Motel Guest Rooms
    - 30 Minute Room Vacated Lighting Switched OFF

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STATE OF CALIFORNIA
INDOOR LIGHTING – LIGHTING CONTROLS
CEC-NRCC-LTI-02-E (Revised 01/16)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE	NRCC-LTI-02-E
Indoor Lighting - Lighting Controls	(Page 1 of 3)
Project Name	Date Prepared

A. Mandatory Lighting Control Declaration Statements (Indicate if the measure applies by checking yes or no below.)

YES	NO	Control Requirements
○	○	Lighting shall be controlled by self-contained lighting control devices which are certified to the Energy Commission according to the Title 20 Appliance Efficiency Regulations in accordance with Section 110.9.
○	○	Lighting shall be controlled by a lighting control system or energy management control system in accordance with §110.9. An Installation Certificate shall be submitted in accordance with Section 130.4(b).
○	○	One or more Track Lighting Integral Current Limiters shall be installed which have been certified to the Energy Commission in accordance with §110.9 and §130.0. Additionally, an Installation Certificate shall be submitted in accordance with Section 130.4(b).
○	○	A Track Lighting Supplementary Overcurrent Protection Panel shall be installed in accordance with Section 110.9 and Section 130.0. Additionally, an Installation Certificate shall be installed in accordance with Section 130.4(b).
○	○	All lighting controls and equipment shall comply with the applicable requirements in §110.9 and shall be installed in accordance with the manufacturer's instructions in accordance with Section 130.1.
○	○	All luminaires shall be functionally controlled with manual ON and OFF lighting controls in accordance with Section 130.1(a).
○	○	General lighting shall be separately controlled from all other lighting systems in an area. Floor and wall display, window display, case display, ornamental, and special effects lighting shall each be separately controlled on circuits that are 20 amps or less. When track lighting is used, general, display, ornamental, and special effects lighting shall each be separately controlled; in accordance with Section 130.1(a)4.
○	○	The general lighting of any enclosed area 100 square feet or larger, with a connected lighting load that exceeds 0.5 watts per square foot shall meet the multi-level lighting control requirements in accordance with Section 130.1(b).
○	○	All installed indoor lighting shall be equipped with controls that meet the applicable Shut-OFF control requirements in Section 130.1(c).
○	○	Lighting in all Daylit Zones shall be controlled in accordance with the requirements in Section 130.1(d) and daylit zones are shown on the plans.
○	○	Lighting power in buildings larger than 10,000 square feet shall be capable of being automatically reduced in response to a Demand Responsive Signal in accordance with Section 130.1(e).
○	○	Before an occupancy permit is granted for a newly constructed building or area, or a new lighting system serving a building, area, or site is operated for normal use, indoor lighting controls serving the building, area, or site shall be certified as meeting the Acceptance Requirements for Code Compliance in accordance with Section 130.4(a). The controls required to meet the Acceptance Requirements include automatic daylight controls, automatic shut-OFF controls, and demand responsive controls.

MANDATORY LIGHTING CONTROLS

§ 130.1(d) Automatic Daylighting Controls

Primary Zone only For skylights

Daylit Zones:
A. Skylight Daylit Zone
B. Primary Sidelit Daylit Zone
C. Secondary Sidelit Daylit Zone

Daylit Zone: *Is the floor area under skylights or next to windows. Types of daylit zones includes primary sidelit daylit zone, secondary sidelit daylit zone, and skylit daylit zone.*

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MANDATORY LIGHTING CONTROLS

§ 130.1(d) Automatic Daylighting Controls

Daylit Zones:
A. Skylight Daylit Zone

Area under the opening
Plus
0.7 times average ceiling height
Minus
Areas permanent obstruction

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lights in the skylight zone shall shut off by dimming to percentages ~~as shown on pg~~

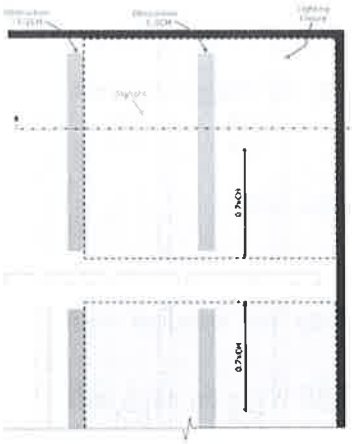

Figure 5-5 – Skylit Daylit Zone Diagram 1

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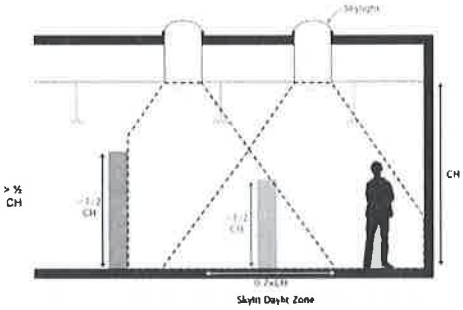

Figure 5-6 – Skylit Daylit Zone Diagram 2

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MANDATORY LIGHTING CONTROLS

§ 130.1(d) Automatic Daylighting Controls

Daylit Zones:
B. Primary Sidelit Daylit Zone

Vertical Glazing
One window head height deep and window width
Plus
0.5 times window head height wide on each side
Minus
Areas permanent obstruction

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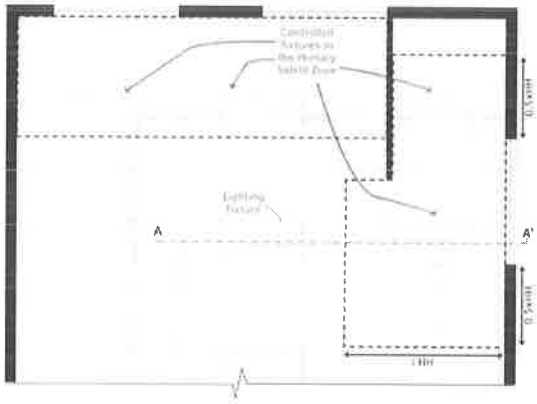

Figure 5-7 – Primary Sidelit Daylit Zone Diagram 1

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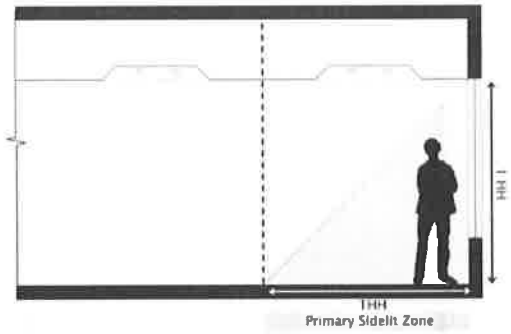

Figure 5-8 – Primary Sidelit Daylit Zone Diagram 2

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MANDATORY LIGHTING CONTROLS

§ 130.1(d) Automatic Daylighting Controls

Daylit Zones:

C. Secondary Sidelit Daylit Zone

Vertical Glazing

Two window head height deep and window width

Plus

0.5 times window head height wide on each side

Minus

Areas permanent obstruction

California Building Officials

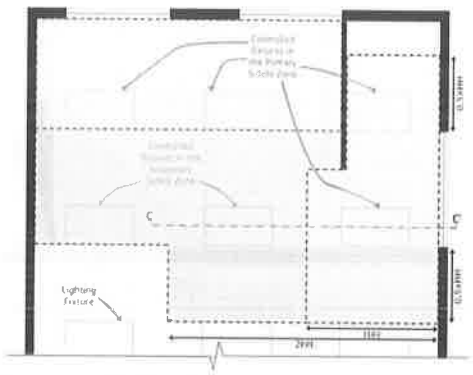


Figure 5-9 – Secondary Sidelit Daylit Zone Diagram 1

MANDATORY LIGHTING CONTROLS

§ 130.1(d) Automatic Daylighting Controls

Installation and Operation:

- D.i. Photosensors (not readily available non-authorized)
- D.ii. Multilevel Lighting Control Steps

- Luminaires in Skylit and Primary Daylit Zones: Auto DL Controls
- Skylit and Primary Daylit Controlled Separately
- Minimum Illuminance: When no daylight is available
- Reduce by 65% when daylight > 150% design illuminance

Outdoor Lighting, Signs, Solar Ready

California Building Officials

Outdoor Lighting Controls & Equipment

§ 130.2

- Incandescent >100 watts: Motion Sensor
- Luminaire Cutoff > 150 watts: Backlight/Uplight/Glare "BUG" – Table 130.2-A Uplight; Table 130.2-B Glare

Outdoor Lighting Controls & Equipment

§ 130.2

- Controls:
  - Photocontrol or Astronomical time-switch
  - Circuited independently by automatic scheduling control
  - Where < 24 feet above the ground
- Sales Frontage, Sales Lots, Sales Canopies
  - Part-night automatic control
  - Motion sensors
- Building Façade

Sign Lighting Controls

§ 130.3

- Indoor Signs: Automatic time-switch or Astronomical control
- Outdoor Signs:
  - Photocontrol PLUS Automatic or Astronomical time-switch
  - Day & Night: Dimmer Reduce by 65% nighttime
- Demand Responsive Control: Electronic Message Center
  - > 15kW: Reduce by 30% when receiving demand signal

MANDATORY REQUIREMENTS
SOLAR READY BUILDINGS

§ 110.10: *When Does This Section Apply?*

- SFD = Subdivision, 10 or More
- Low-Rise MFD
- High-Rise MFD: 10 Stories or Less
- Hotels, Motels
- Non-Res = Three Stories or Less

California Building Officials

MANDATORY REQUIREMENTS
SOLAR READY BUILDINGS

§ 110.10

Solar Zone: ***A section of the roof designated and reserved for the future installation of a solar electric or solar thermal system.***

- Access, Pathway, Smoke Ventilation, Spacing: Part 9 ← Fire Code
- No Shading in Solar Zone
- Minimum Dimensions:
  - 80 Sq Ft, Roof Area <= 10,000SF
  - 160 Sq Ft, Roof Area > 10,000SF
  - 250 Sq Ft, SFD (Exceptions)

California Building Officials

MANDATORY REQUIREMENTS
SOLAR READY BUILDINGS

§ 110.10

- Dead Load, Live Load Indicated on Plans
  (load for future installation only)
- Pathway for Routing of Conduit on Plans
- Documentation Provided to Occupant
- SFD: *Minimum 200A* (Sub-Div, 10 or More)
  - Reserved Space 2-Pole CB
  - Opposite End From Main CB
  - Space Marked: ***"For Future Solar Electric"***

Minimum 200 amp panels for sub-div.

California Building Officials

PERFORMANCE METHOD

California Building Officials

Project Name:	Nonresidential Sample	NRCC-PRF-01-E	Page 1 of 21
Project Address:	1234 Main St, Sacramento 95800	Calculation Date/Time:	13:26, Tue, Jul 19, 2016
Compliance Scope:	NewComplete	Input File Name:	Nonres Sample.cbd16x

A. PROJECT GENERAL INFORMATION

1.	Project Location (City)	Sacramento	8.	Standards Version	Compliance2016
2.	CA Zip Code	95800	9.	Compliance Software (version)	EnergyPro 7.1
3.	Climate Zone	12	10.	Building Orientation (deg)	(N) 0 deg
4.	Total Conditioned Floor Area in Scope	4,480 ft²	11.	Permitted Scope of Work	NewComplete
5.	Total Unconditioned Floor Area	800 ft²	12.	Building Type(s)	Nonresidential
6.	Total # of Stories (Habitable Above Grade)	2	13	Gas Type	Natural Gas
7.	Total # of dwelling units	0			

B. COMPLIANCE RESULTS FOR PERFORMANCE COMPONENTS (Annual TDV Energy Use, kBtu/ft²-yr) — § 140.1

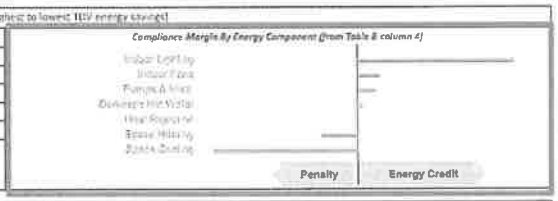
BUILDING COMPLIES

1. Energy Component	2. Standard Design (TDV)	3. Proposed Design (TDV)	4. Compliance Margin (TDV)	5. Percent Better than Standard
Space Heating	14.5	17.6	-3.0	-20.5%
Space Cooling	100.4	112.5	-12.1	-12.1%
Indoor Fans	45.4	43.6	1.8	4.0%
Heat Rejection	--	--	--	--
Pumps & Misc.	1.5	--	1.5	--
Domestic Hot Water	25.6	25.2	0.4	1.5%
Indoor Lighting	86.1	67.5	18.6	21.6%
COMPLIANCE TOTAL	273.5	266.4	7.1	2.6%
Receptacle	75.1	75.1	0.0	0.0%
Process	72.7	72.7	0.0	0.0%
Other Ltg	--	--	--	--
TOTAL	415.8	414.2	1.6	0.4%

Project Name:	Nonresidential Sample	NRCC-PRF-01-E	Page 2 of 21
Project Address:	1234 Main St, Sacramento 95800	Calculation Date/Time:	13:26, Tue, Jul 19, 2016
Compliance Scope:	NewComplete	Input File Name:	Nonres Sample.cbd16x

C. PRIORITY PLAN CHECK/ INSPECTION ITEMS (in order of highest to lowest TDV energy savings)

1st	Indoor Lighting: Check lighting
2nd	Indoor Fans: Check envelope and mechanical
3rd	Pumps & Misc.: Check mechanical
4th	Domestic Hot Water: Check mechanical
5th	Heat Rejection: Check envelope and mechanical
6th	Space Heating: Check envelope and mechanical
7th	Space Cooling: Check envelope and mechanical



D. EXCEPTIONAL CONDITIONS

The general lighting exceptional method is employed for one or more spaces. Verify that the lighting allowances match the lighting installed on the plans and serve the areas within each space as identified in the compliance model.

The proposed building claims credit for non-mandatory lighting control credits via Power Adjustment Factors (PAFs) as outlined in Standards Table 140.6-A. Review NRCC-PRF-01 DETAILS Table A to ensure that credit is not claimed for mandatory controls

This project includes Domestic Hot Water in the analysis. Please verify that Domestic Hot Water is included in the design for the permitted scope of work

E. HERS VERIFICATION

This Section Does Not Apply

F. ADDITIONAL REMARKS

Standard Building (Compliance)

Project Name:	Nonresidential Sample	NRCC-PRF-01-E	Page 12 of 21
Project Address:	1234 Main St. Sacramento 95800	Calculation Date/Time:	13:26, Tue, Jul 19, 2016
Compliance Scope:	New/Complete	Input File Name:	Nonres Sample.cibd16x

R. INDOOR CONDITIONED LIGHTING SCHEDULE (Adapted from NRCC-LTI-01-E) — § 130.0

Luminaire Schedule (includes all permanent installed lighting in conditioned space, and portable lighting over 0.8 w/ft² in offices)		Installed Watts (Conditioned)					Confirmed	
Name or Item Tag	Complete Luminaire Description (i.e., 3-lamp fluorescent troffer, F32T8, and dimmable electronic ballast)	Watts per luminaire	How Wattage is Determined: CEC Default from NAB	How Wattage is Determined: According to §130.0(c)	Total Number Luminaires	Installed Watts	Pass	Fail
F-1	(2) 4 ft Fluorescent T8 Rapid Start Elec	62	Yes	No	20	1,240	☐	☐
A-1	(2) 4 ft Fluorescent T8 Rapid Start Elec	62	Yes	No	27	1,674	☐	☐
L-1	(2) 1 lw Compact Fluorescent Twin 2 Pin	34	Yes	No	20	680	☐	☐
F-2	45w per ft Track Light	45	Yes	No	20	900	☐	☐

* Lighting power density was used in the compliance report Building Department is based on their prescriptive forms for luminaire schedule details

S1. COVERED PROCESS SUMMARY – ENCLOSED PARKING GARAGES — § 140.9

This Section Does Not Apply

S2. COVERED PROCESS SUMMARY – COMMERCIAL KITCHENS — § 140.9

This Section Does Not Apply

S3. COVERED PROCESS SUMMARY – COMPUTER ROOMS — § 140.9

This Section Does Not Apply

S4. COVERED PROCESS SUMMARY – LABORATORY EXHAUSTS — § 140.9

This Section Does Not Apply

T. UNMET LOAD HOURS

This Section Does Not Apply

Project Name:	Nonresidential Sample	NRCC-PRF-01-E	Page 19 of 21
Project Address:	1234 Main St. Sacramento 95800	Calculation Date/Time:	13:26, Tue, Jul 19, 2016
Compliance Scope:	New/Complete	Input File Name:	Nonres Sample.cibd16x

NRCC-PRF-LTI-DETAILS -SECTION START-

A. INDOOR CONDITIONED LIGHTING CONTROL CREDITS (Adapted from NRCC-LTI-02-E) — § 140.6

Lighting Control Credits Schedule (includes all lighting controls installed in conditioned space for compliance credit per §140.6(a)2 and Table 140.6-A)				Control Credit Calculation			If Acceptance Test Required	Confirmed	
Location in Building	Occupancy Type (must meet requirements of Table 140.6-A)	Type/Description of Lighting Control (i.e., partial on occupancy sensor, manual dimming, etc.)	# of Units	Watts of Controlled Lighting	Power Adjustment Factor	Control Credit Watts		Pass	Fail
S-1 Retail Zone	Retail Merchandise Sales, Wholesale Showroom	- none specified -	1		0.00	0		☐	☐
S-3 Office Zone	Office (Greater than 250 square feet in floor area)	OccupantSensingControls: 251to500SF	1		0.20	335	A	☐	☐
S-4 Restaurant Zone	Dining Area	- none specified -	1		0.00	0		☐	☐
S-4 Restaurant Zone	Dining Area	- none specified -	1		0.00	0		☐	☐

B. INDOOR CONDITIONED LIGHTING MANDATORY LIGHTING CONTROLS (Adapted from NRCC-LTI-02-E) — § 130.1

This Section Does Not Apply

§130.1(a) = Manual area controls §130.1(b) = Multi-level §130.1(c) = Auto Shut Off §130.1(d) = Partial Day Lighting §130.1(e) = Demand Response

C. TAILORED METHOD CONDITIONED LIGHTING POWER ALLOWANCE SUMMARY AND CHECKLIST (Adapted from NRCC-LTI-04-E) — § 140.6

General lighting power (see Table D)	0
General lighting power from special function areas (see Table E)	NA
Additional "use it or lose it" (See Table G)	0
Total watts	0

D. GENERAL LIGHTING POWER (Adapted from NRCC-LTI-04-E) — § 140.6-D

This Section Does Not Apply

PRESCRIPTIVE METHOD

California Building Officials

PRESCRIPTIVE INDOOR LIGHTING

§ 140.6

A Building Complies if . . .

- Actual LPD <= Allowed LPD
- Calculate Actual Indoor LPD separate from Actual Outdoor LPD
- Automatic Daylighting Requirements in Secondary Daylit Zone

California Building Officials

PRESCRIPTIVE INDOOR LIGHTING

§ 140.6(a)

Calculating Actual Indoor Lighting Power Density

- Lighting Systems – No more than 2: Interlock if more than 2
- Reduction (Lighting Control Credits)
  - Power Adjustment Factor: Table 140.6-A

California Building Officials

TABLE 140.6-A LIGHTING POWER ADJUSTMENT FACTORS (PAF)

TYPE OF CONTROL	TYPE OF AREA		FACTOR
a. To qualify for any of the Power Adjusment 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. Daylight Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone		0.10
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. Institutional Tuning	Luminaires in non-daylit areas: Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.		0.10
	Luminaires in daylit areas: Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.		0.05
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

California Building Officials

PRESCRIPTIVE INDOOR LIGHTING

§ 140.6(a)

Calculating Actual Indoor Lighting Power Density

- Exempt Lighting
- Luminaries shall comply with Mandatory Measures

California Building Officials

PRESCRIPTIVE INDOOR LIGHTING

§ 140.6

Allowed Lighting Power Density Methodologies:

- Complete Building Method
- Area Category Method
- Tailored Method

California Building Officials

TABLE 140.6-B COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES

TYPE OF BUILDING	ALLOWED LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)
Auditorium Building	1.4 (1.5)
Classroom Building	1.1
Commercial and Industrial Storage Building	0.60
Convention Center Building	1.0 (1.2)
Financial Institution Building	1.0 (1.1)
General Commercial Building/Industrial Work Building	1.00
Grocery Store Building	1.50
Library Building	1.2 (1.3)
Medical Building/Clinic Building	1.0 (1.1)
Office Building	0.80
Parking Garage Building	0.20
Religious Facility Building	1.5 (1.6)
Restaurant Building	1.1 (1.2)
School Building	0.95 (1.0)
Theater Building	1.3
All others buildings	0.50 (0.6)

California Building Officials

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

PRIMARY FUNCTION AREA	ALLOWED LIGHTING POWER DENSITY (W/ft²)	PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER DENSITY (W/ft²)
Auditorium Area (1.5)	1.40 [3]	Library Area	Reading areas	1.1 [3] (1.2)
Auto Repair Area	0.90 [2]		Stack areas	1.5 [3]
Beauty Salon Area	1.7	Lobby Area	Hotel lobby	0.95 [3] (1.1)
Civic Meeting Place Area	1.4 [3]		Main entry lobby	0.95 [3] (1.5)
Classroom, Lecture, Training, Vocational Areas	1.2 [3]	Locker/Dressing Room		0.70 (0.8)
Commercial and Industrial Storage Areas (conditioned and unconditioned)	0.60	Lounge Area		0.90 [3] (1.1)
Commercial and Industrial Storage Areas (refrigerated)	0.7	Malls and Atria		0.95 [3] (1.2)
Convention, Conference, Multipurpose and Meeting Center Areas (1.4)	1.2 [3]	Medical and Clinical Care Area		1.2
Corridor, Restroom, Stair, and Support Areas	0.60	Office Area	> 250 square feet	0.73
Dining Area (1.1)	1.0 [3]		≤ 250 square feet	1.0
Electrical, Mechanical, Telephone Rooms (0.7)	0.55 [2]	Parking Garage Area	Parking Area [10]	0.14
Exercise Center, Gymnasium Areas	1.0		Dedicated Ramps	0.30
Exhibit, Museum Areas (2.0)	1.8		Daylight Adaptation Zones [9]	0.60
Financial Transaction Area (1.2)	1.0 [3]	Religious Worship Area		1.5 [3]
General Commercial and Industrial Work Areas: Low bay	0.9 [3]	Retail Merchandise Sales, Wholesale Showroom Areas		1.2 [3 and 8]
General Commercial and Industrial Work Areas: High bay	1.0 [3]			
General Commercial and Industrial Work Areas: Precision	1.2 [3]	Theater Area	Motion picture	0.90 [3]
Grocery Sales Area	1.2 [3 and 8]		Performance	1.4 [3]
Hotel Function Area (1.5)	1.4[3]	Transportation Function Area	Concourse & Baggage	0.50
			Ticketing	1.0
Kitchen, Food Preparation Areas (1.6)	1.2	Videoconferencing Studio		1.2[3]
Laboratory Area, Scientific	1.4[3]	Waiting Area		0.80[3] (1.1)
Laundry Area (0.9)	0.70	All other areas		0.50 (0.6)

California Building Officials

STATE OF CALIFORNIA

INDOOR LIGHTING

(NRCC-LTI-01-E) (Revised 08/16)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE — NRCC-LTI-01-E

Indoor Lighting — (Page 2 of 6)

Project Name: Office Retail Remodel — Date Prepared: 6/24/2016

A. General Information

Climate Zone: 5	Conditioned Floor Area: 10,250					
	Unconditioned Floor Area: 0					
Building Type:	☐	Nonresidential	☐	High Rise Residential	☐	Hotel/Motel
☐ Schools	☐	Relocatable Public Schools	☑	Conditioned Spaces	☐	Unconditioned Spaces
Phase of Construction:	☐	New Construction	☐	Addition	☑	Alteration
Method of Compliance:	☐	Complete Building	☐	Area Category	☑	Tailored

Project Address: 123 Main Street

B. Lighting Compliance Documents (select yes for each document included)

For detailed instructions on the use of this and all Energy Efficiency Standards compliance documents, refer to the Nonresidential Manual published by the California Energy Commission.

YES	NO	COMP. DOC.	TITLE
☑	☐	NRCC-LTI-01-E	Certificate of Compliance. All Pages required on plans for all submittals.
☑	☐	NRCC-LTI-02-E	Lighting Controls, Certificate of Compliance, and PAF Calculation. All Pages required on plans for all submittals.
☑	☐	NRCC-LTI-03-E	Indoor Lighting Power Allowance
☑	☐	NRCC-LTI-04-E	Tailored Method Worksheets
☐	☑	NRCC-LTI-05-E	Line Voltage Track Lighting Worksheets
☐	☐	NRCC-LTI-06-E	Indoor Lighting Existing Conditions

STATE OF CALIFORNIA

INDOOR LIGHTING

(NRCC-LTI-01-E) (Revised 08/16)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE — NRCC-LTI-01-E

Indoor Lighting — (Page 2 of 6)

Project Name: Office Retail Remodel — Date Prepared: 6/24/2016

C. Summary of Allowed Lighting Power

Conditioned and Unconditioned space lighting must not be combined for compliance

	Indoor Lighting Power for Conditioned Spaces		Watts	Indoor Lighting Power for Unconditioned Spaces		Watts
01	Installed Lighting NRCC-LTI-01-E, Table H, page 5	+	12,210	Installed Lighting NRCC-LTI-01-E, Table H, page 5	+	0
02	Portable Only for Offices NRCC-LTI-01-E, Table G, page 4	+				
03	Minus Lighting Control Credits NRCC-LTI-02-E, page 2	-	40	Minus Lighting Control Credits NRCC-LTI-02-E, page 2	-	0
04	Adjusted Installed Lighting Power (row 1 plus row 2 minus row 3)	=	12,169	Adjusted Installed Lighting Power (row 1 minus row 3)	=	0
	Complies ONLY if Installed ≤ Allowed (Box 04 < Box 05)			Complies ONLY if Installed ≤ Allowed (Box 04 < Box 05)		
05	Allowed Lighting Power Conditioned NRCC-LTI-03-E, page 1 — Alterations with replacement luminaires that have at least 50/35% lower power compared to the original existing luminaires, may instead use the allowed wattage from NRCC-LTI-06, page 2		11,870	Allowed Lighting Power Unconditioned NRCC-LTI-03-E, page 1 — Alterations with replacement luminaires that have at least 50/35% lower power compared to the original existing luminaires, may instead use the allowed wattage from NRCC-LTI-06, page 2		0

D. Declaration of Required Certificates of Installation

Declare by selecting yes for all of the Certificates that will be submitted. (Retain copies and verify forms are completed and signed.)

YES	NO	Compliance Document/Title	
☑	☐	NRCC-LTI-01-E - Must be submitted for all buildings	☐ Field Inspector
☑	☐	NRCC-LTI-02-E - Must be submitted for a lighting control system, or for an Energy Management Control System (EMCS), to be recognized for compliance.	☐ Field Inspector
☑	☐	NRCC-LTI-03-E - Must be submitted for a line-voltage track lighting integral current limiter, or for a supplementary overcurrent protection panel used to energize only line voltage track lighting, to be recognized for compliance.	☐ Field Inspector
☐	☑	NRCC-LTI-04-E - Must be submitted for two interlocked systems serving an auditorium, a convention center, a conference room, a multipurpose room, or a theater to be recognized for compliance.	☐ Field Inspector
☑	☐	NRCC-LTI-05-E - Must be submitted for a Power Adjustment Factor (PAF) to be recognized for compliance	☐ Field Inspector
☐	☑	NRCC-LTI-06-E - Must be submitted for additional wattage installed in a video conferencing studio to be recognized for compliance.	☐ Field Inspector

STATE OF CALIFORNIA

INDOOR LIGHTING

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE	NRCC-LTI-01-E
Indoor Lighting	(Page 5 of 6)
Project Name: Office Retail Remodel	Date Prepared: 6/24/2016

E. Declaration of Required Certificates of Acceptance

Declare by selecting yes for all of the Certificates that will be submitted. (Retain copies and verify forms are completed and signed.)

YES	NO	Compliance Document/Title	
☐	☑	**NRCA-LTI-02-A - Must be submitted for occupancy sensors and automatic time switch controls**	☐ Field Inspector
☑	☐	NRCA-LTI-03-A - Must be submitted for automatic daylight controls.	☐ Field Inspector
☐	☑	NRCA-LTI-04-A - Must be submitted for demand responsive lighting controls.	☐ Field Inspector
☐	☑	NRCA-LTI-05-A - Must be submitted for institutional tuning power adjustment factor (PAF).	☐ Field Inspector

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

F. Indoor Lighting Schedule and Field Inspection Energy Checklist

☐ The actual indoor lighting power listed on the next 2 pages includes all installed permanent and planned portable lighting systems.

☐ When Complete Building Method is used for compliance, list each different type of luminaire on separate lines.

☐ When Area Category Method or Tailored Method is used for compliance, list each different type of luminaire by each different function area on separate lines

☐ Also include track lighting in schedule, and submit the track lighting compliance document (NRCC-LTI-05-E) when line-voltage track lighting is installed.

STATE OF CALIFORNIA

INDOOR LIGHTING

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE	NRCC-LTI-01-E
Indoor Lighting	(Page 6 of 6)
Project Name: Office Retail Remodel	Date Prepared: 6/24/2016

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT

I, _____, certify that this Certificate of Compliance documentation is accurate and complete.

Documentation Author Name:	Documentation Author Signature:
Company: DEBUG	Signature Date: 6/24/2016
Address:	CEA/HERS Certification Identification (if applicable):
City/State/Zip:	Phone:

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 Compliance is true and correct.
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).
3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with the building permit application.
5. I will ensure that a completed signed copy of this Certificate of Compliance shall be 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 the Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.

Responsible Designer Name: Joe King	Responsible Designer Signature:
Company: Joe's Electric	Date Signed:
Address: 123 Bada Bing St	License:
City/State/Zip: Oakley, CA 92003	Phone: (555) 222-1212

ELECTRICAL SYSTEMS

California Building Officials

MANDATORY REQUIREMENTS
ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 110.11

Certification by Manufacturers
- Of equipment listed in this Section
- Certified to the Commission

(a) Low-Voltage Dry-Type Transformers
- Exceptions

ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5

a) Service Metering
b) Separation of Electrical Circuits Electrical Energy Monitoring
c) Voltage Drop
d) Circuit Control 120 Volt Receptacles and Controlled Receptacles
e) Demand Response Controls & Equipment

California Building Officials

ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5: *When Does This Section Apply?*

- Non-Residential, High-Rise Residential, Hotels & Motels

California Building Officials

ELECTRICAL POWER DISTRIBUTION SYSTEMS

TABLE 100.0-A APPLICATION OF STANDARDS

Occupancies	Application	Mandatory	Prescriptive	Performance	Additions/Alterations
General Provisions for All Buildings		100.0, 100.1, 100.2, 110.0			
Nonresidential, High-Rise Residential, And Hotels/Motels	General	120.0	140.0, 140.2	140.0, 140.1	141.0
	Envelope (conditioned)	110.6, 110.7, 110.8, 120.7	140.3		
	Envelope (unconditioned process spaces)	N.A.	140.3(c)		
	HVAC (conditioned)	110.2, 110.5, 120.1, 120.2, 120.3, 120.4, 120.5, 120.8	140.4		
	Water Heating	110.3, 120.3, 120.8, 120.9	140.5		
	Indoor Lighting (conditioned, process spaces)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6		
	Indoor Lighting (unconditioned and parking garages)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6		
	Outdoor Lighting	110.9, 130.0, 130.2–130.4	140.7		
	Electrical Power Distribution	110.11, 130.5	N.A.		
	Pool and Spa Systems	110.9, 110.10, 150.0(p)	N.A.		141.0
	Solar Ready Buildings	110.10	N.A.		141.0(a)
Covered Processes[1]	Envelope, Ventilation, Process Loads	110.2, 120.6	140.9	140.1	120.6, 140.9
Signs	Indoor and Outdoor	130.0, 130.3	140.8	N.A.	141.0, 141.0(b)2H

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ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5: *When Does This Section Apply?*

- Non-Residential, High-Rise Residential, Hotels & Motels
- New Construction
- Additions: § 141.0(a) – Lighting, Cond Space, Outdoor Lighting
- Alterations: § 141.0(b)2. – Altered Lighting, New Equipment
- Alterations: § 141.0(b)2.F. – First Time Lighting (Shell/TI)

ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5: *When Does This Section Apply?*

§ 141.0(b)2.P.: Electrical Power Distribution Systems

- Metering: New *or Replaced* Electrical Service
- Separation Circuit: New *or Replaced* Panelboards
- Voltage Drop: Addition, Modification, *Replacement* Feeders
- Controlled Receptacles: New *or Replaced* Distribution System

ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5(a) Service Metering

- Metering of Total Energy Use – Table 130.5-A

TABLE 130.5-A MINIMUM REQUIREMENTS FOR METERING OF ELECTRICAL LOAD

Metering Functionality	Electrical Services rated 50 kVA or less	Electrical Services rated more than 50kVA and less than or equal to 250 kVA	Electrical Services rated more than 250 kVA and less than or equal to 1000kVA	Electrical Services rated more than 1000kVA
Instantaneous (at the time) kW demand	Required	Required	Required	Required
Historical peak demand (kW)	Not required	Not required	Required	Required
Tracking kWh for a user-definable period	Required	Required	Required	Required
kWh per rate period	Not required	Not required	Not required	Required

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ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5(b) Separation of Electrical Circuits

- Designed to Allow Measurement of Electrical Load Uses
- Separate Distribution Systems, MCC's, Load Centers
- Table 130.5-B

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ELECTRICAL POWER DISTRIBUTION SYSTEMS

TABLE 130.5-B MINIMUM REQUIREMENTS FOR SEPARATION OF ELECTRICAL LOAD

Electrical Load Type	Electrical Services rated 50 kVA or less	Electrical Services rated more than 50kVA and less than or equal to 250 kVA	Electrical Services rated more than 250 kVA and less than or equal to 1000kVA	Electrical Services rated more than 1000kVA
Lighting including exit and egress lighting and exterior lighting	Not required	All lighting in aggregate	All lighting disaggregated by floor, type or area	All lighting disaggregated by floor, type or area
HVAC systems and components including chillers, fans, heaters, furnaces, package units, cooling towers, and circulation pumps associated with HVAC	Not required	All HVAC in aggregate	All HVAC in aggregate and each HVAC load rated at least 50 kVA	All HVAC in aggregate and each HVAC load rated at least 50kVA
Domestic and service water system pumps and related systems and components.	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Plug load including appliances rated less than 25 kVA	Not required	All plug load in aggregate Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf	All plug load separated by floor, type or area Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf	All plug load separated by floor, type or area All groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf
Elevators, escalators, moving walks, and transit systems	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Other individual non-HVAC loads or appliances rated 25kVA or greater	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Industrial and commercial load centers 25 kVA or greater including theatrical lighting installations and commercial kitchens.	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Renewable power source (net or total)	Each group	Each group	Each group	Each group
Loads associated with renewable power source	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Charging stations for electric vehicles	All loads in aggregate	All loads in aggregate	All loads in aggregate	All loads in aggregate

ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5(c) Voltage Drop is a matter of design

1. Feeders: Maximum 2% V.D. Design Load
2. Branch Circuits: Maximum 3% V.D. Design Load

Voltage drop creates more current & a cause of over heating.

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ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5(c) Voltage Drop

~~1. Feeders: Maximum 2% V.D. Design Load~~
~~2. Branch Circuits: Maximum 3% V.D. Design Load~~
~~*Exception: Emergency Circuit*~~

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ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5(c) Voltage Drop

1. Feeder + Branch Circuit: Maximum 5% V.D. Design Load

Exceptions:
647.4 Sensitive Electronic Equipment 2.5% Max
695.6 Fire Pumps
695.7 Fire Pump Operation 15% Max Starting
5% Max @ 115% FLC @ Controller

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ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5(d) Circuit Control 120-Volt Receptacles

- All Buildings
- Controlled & Uncontrolled Receptacles *SHALL BE PROVIDED*
- Office Areas, Lobbies ,Conference Rooms, Kitchen in Office Area, Copy Rooms

- Controlled Receptacles = Shut-OFF Controls

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ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5(d) Circuit Control 120-Volt Receptacles

- Uncontrolled Receptacles
- ONE Controlled Receptacle w/in 6 feet of Uncontrolled
- Controlled Receptacles Marked (to distinguish)

symbol for uncontrolla receptacals

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ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5(d) Circuit Control 120-Volt Receptacles

- Circuit control Auto Shut-OFF
- Unoccupied
- At Receptacle or Circuit Level
- Automatic Time Switch 2 Hour Override

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ELECTRICAL POWER DISTRIBUTION SYSTEMS

§ 130.5(d)4. Hotel, Motel Guest Rooms

- One-Half Receptacles Controlled
- Captive Key Card Controls, Occupancy Sensor, Automatic Controls

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ADDITIONS -&- ALTERATIONS

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ADDITIONS, ALTERATIONS AND REPAIRS

§ 141.0(a)

Additions

- Prescriptive Approach:
  - *Comply with all requirements*
  - *Electrical Power Distribution Systems*

- Performance Approach:
  - *Comply with all requirements*
  - *Electrical Power Distribution Systems*

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ADDITIONS, ALTERATIONS AND REPAIRS

§ 141.0(b)(I)(i)

Alterations

- Lighting Alterations: Table 141.0-E
  - (a) Removing, Reinstalling 10% or More (E) Luminaires
  - (b) Replacing or Adding Entire Luminaires
  - (c) Adding, Removing or Replacing Walls Ceilings

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ADDITIONS, ALTERATIONS AND REPAIRS

§ 141.0(b)(I)(ii)

Alterations

- Lighting Alterations - Existing Replaced with New
  - Office, Retail, Hotel
  - 50% Lower Power Rating: ***New versus Existing***
  - All Other Occupancies
  - 35% Lower Power Rating: ***New versus Existing***

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ADDITIONS, ALTERATIONS AND REPAIRS

§ 141.0(b)(J)

Component Modification

- Replace Ballast or Drivers & Lamps
- Changing the Light Source of the Luminaire
- Changing the Optical System of the Luminaire
- 70 or More Existing are Modified

➡ Calculations
Controls Table 141.0-E
(50% -&- 35%)

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ADDITIONS, ALTERATIONS AND REPAIRS

§ 141.0(b)(K)

Lighting Wiring Alterations
- For each Enclosed Space

✓ Add a Circuit Feeding Luminaires
✓ Replace, Modify, Relocate Wiring – Between Switch & Panelboard or Luminaire
✓ Replace Lighting Control Panel

➡ Calculations
Controls
One-Step 30 to 70%
10 or More within Daylit

ADDITIONS, ALTERATIONS AND REPAIRS

§ 141.0(b)(P)

Electrical Power Distribution Systems
- **Must Meet Section 130.5**

- **New Electrical Service (metering requirements)**
- **Separation of Circuits: New or Replaced Distribution**
- **Voltage Drop: Alteration of Feeders AND Branch Circuits**
- **Controlled Receptacles: New, Replaced Distribution System**

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ADDITIONS, ALTERATIONS AND REPAIRS

TABLE 141.0-E CONTROL REQUIREMENTS FOR ENTIRE LUMINAIRE ALTERATIONS

Control requirements that shall be met when 10% or more of existing luminaires in an enclosed space are altered	**Resulting lighting power, compared to the lighting power allowance specified in Section 140.6(c)2, Area Category Method**	
	Lighting power is ≤ 85% of allowance	**Lighting power is > 85% to 100% of allowance**
Section 130.1(a)1, 2, and 3 Area Controls	Yes	Yes
Section 130.1(b) Multi-Level Lighting Controls – only for alterations to general lighting of enclosed spaces 100 square feet or larger with a connected lighting load that exceeds 0.5 watts per square foot	For each enclosed space, minimum one step between 30-70 percent of lighting power regardless of luminaire type, or meet Section 130.1(b)	Yes
Section 130.1(c) Shut-Off Controls	Yes	Yes
Section 130.1(d) Automatic Daylight Controls	Not Required	Yes
Section 130.1(e) Demand Responsive Controls – only for alterations > 10,000 ft^2 in a single building, where the alteration also changes the area of the space, or changes the occupancy type of the space, or increases the lighting power	Not Required	Yes

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EXAMPLE

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EXAMPLE – NEW OFFICE BUILDING

- Regular Building
- 20,000 Square Feet
- Surface Parking – Outdoor Lighting
- Building Sign

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EXAMPLE – NEW OFFICE BUILDING

Mandatory Requirements

- Space-Area Controls: Manual Controls ON/OFF
- Multi-Level Lighting: Luminaire Dimming
  Manual Dimmer
  Daylight Controls
  Demand Response (>10,000 SF)

Check with the utility to verify they have the demand responce

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EXAMPLE – NEW OFFICE BUILDING

Mandatory Requirements

- Automatic Daylit Controls: Luminaire Dimming
  Daylit Controls
- Shut-Off Controls: Occupancy Sensor *or*
  Manual ON / Auto OFF *or*
  Automatic Time Switch *or*
  Remote Control Signaling
  Receptacle Controls

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EXAMPLE – NEW OFFICE BUILDING

Forms – Certificate of Acceptance

- NRCA-LTI-02-A: Lighting Control Acceptance Document
- NRCA-LTI-03-A: Automatic Daylighting Control Acceptance
- NRCA-LTI-04-A: Demand Responsive Lighting Control Acceptance
- NRCA-LTO-02-A: Outdoor Lighting Acceptance Tests
- NRCA-PRC-12F: Elevator Lighting & Ventilation Controls
- NRCA-PRC-13F: Escalator & Moving Walkways Speed Control

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EXAMPLE – NEW OFFICE BUILDING

Forms – Certificate of Compliance

- NRCC-CXR-01-E: Design Review Kickoff
- NRCC-CXR-02-E: Commissioning – Construction Documents
- NRCC-CXR-05-E: Commissioning – Design Review Signature Page

- NRCC-ELC-01-E: Electrical Power Distribution

- NRCC-LTI-01-E: Indoor Lighting
- NRCC-LTI-02-E: Indoor Lighting – Lighting Controls
- NRCC-LTI-03-E: Indoor Lighting Power Allowance
- NRCC-LTI-05-E: Line-Voltage Track Lighting Worksheet

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EXAMPLE – NEW OFFICE BUILDING

Forms – Certificate of Compliance

- NRCC-LTO-01-E: Outdoor Lighting
- NRCC-LTO-02-E: Outdoor Lighting Controls
- NRCC-LTO-03-E: Outdoor Lighting Power Allowances
- NRCC-LTS-01-E: Sign Lighting

- NRCC-PRC-12E: Elevator Lighting and Ventilation Controls
- NRCC-PRC-13E: Escalator Moving Walkways Speed Controls

- NRCC-SRA-01-E: Solar Ready Areas
- NRCC-SRA-02-E: Minimum Solar Zone Area Worksheet

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EXAMPLE – NEW OFFICE BUILDING

Forms – Certificate of Installation

- NRCI-ELC-01-E: Electrical Power Distribution
- NRCI-LTI-01-E: Indoor Lighting
- NRCI-LTI-02-E: Energy Mgt Control or Lighting Control System
- NRCI-LTI-03-E: Track Lighting Integral Current Limiter or Supplementary Overcurrent Protection Panel
- NRCI-LTI-04-E: Two Interlocked Lighting Systems
- NRCI-LTI-05-E: Power Adjustment Factors

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EXAMPLE – NEW OFFICE BUILDING

Forms – Certificate of Installation

- NRCI-LTO-01-E: Outdoor Lighting
- NRCI-LTO-02-E: Energy Mgt Control or Lighting Control System
- NRCI-LTS-01-E: Sign Lighting
- NRCI-SPV-01-E: Solar Photovoltaic System

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MANDATORY LIGHTING CONTROLS

§ 130.1(e) Demand Responsive Controls

- Buildings > 10,000 Square Feet
- Lighting power automatically reduced by 15%
- Uniform Illumination Levels: Table 130.1-A
- Demand Responsive Signal

Demand Responsive Signal: *Signal sent by the utility or service provider indicating a request to modify consumption for a limited time period.*
Demand Responsive Control: *Receiving and automatically responding to a demand response signal.*

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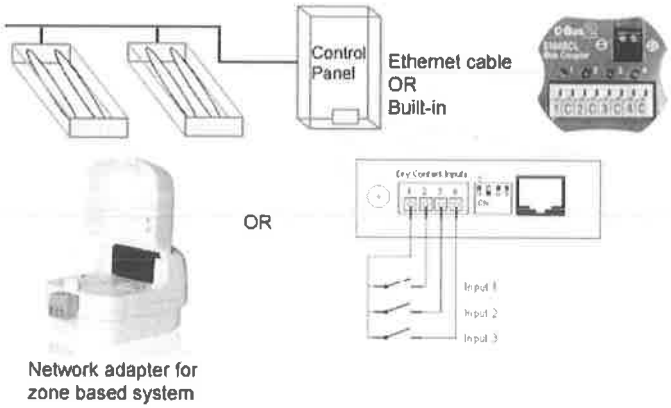

Figure 5-13 - Potential inputs to receive Demand Response signal

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COMMISSIONING - C_X

§ 120.8 Non-Residential Building Commissioning

- *Owner Project Requirements*
- *Basis of Design*
- *Design Phase Design Review*
- *Construction Document Measures*
- *Cx Plan*
- *Functional Performance Testing*
- *Documentation and Training*
- *Commissioning Report*

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Questions

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Thank You!

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