About your Presenter

- Lyn Gomes, PE, LEED AP, CLCATT
- kW’s Lead CxA
- Triple Talent
  - HVAC Design
  - Construction
  - Startup
- Specialist
  - Commissioning
  - Design Review
  - Meme educator

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What we’ll cover

- Title 24 2013
- Players
- Process overview
- Installation certification
- Acceptance tests
SECTION 110.9
MANDATORY REQUIREMENTS FOR LIGHTING CONTROL DEVICES AND SYSTEMS, BALLASTS AND LUMINAIRES

(a) All lighting control devices and systems, ballasts and luminaires subject to the requirements of Section 110.9 shall meet the following requirements:

1. Shall be installed only if the lighting control device or system, ballast or luminaire complies with all of the applicable requirements of Section 110.9.
2. Lighting controls may be individual devices (Self-Contained lighting control) or systems (Lighting control

SECTION 130.4
LIGHTING CONTROL ACCEPTANCE AND INSTALLATION CERTIFICATE REQUIREMENTS

(b) Lighting control installation certificate requirements. To be recognized for compliance with Part 6 an installation certificate shall be submitted in accordance with Section 10-103(a) for any lighting control system, energy management control system, track lighting integral current limiter, track lighting supplementary overcurrent protection panel, interlocked lighting system, lighting power adjustment factor, or additional wattage available for a videoconference studio, in

SECTION 120.8
BUILDING COMMISSIONING

For all new nonresidential buildings, the subsections of 120.8 (a) through (i) for building commissioning shall be included in the design and construction processes of the building project to verify that the building energy systems and components meet the owner’s or owner representative’s project requirements. All building systems and components covered by Sections 110.0, 120.0, 130.0 and 140.0 shall be included in the scope of the commissioning requirements in this section, excluding covered processes. For buildings less than 10,000 ft², only the design review requirements in Sections 120.8(d) and 120.8(e) shall be completed.
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SECTION 130.4
LIGHTING CONTROL ACCEPTANCE AND INSTALLATION CERTIFICATE REQUIREMENTS

(c) When certification is required by Title 24, Part 1, Section 10-103-A, the acceptance testing specified by Section 130.4 shall be performed by a certified lighting controls acceptance test technician (CLCATT). If the CLCATT is operating as an employee, the CLCATT shall be certified as a lighting controls acceptance test technician. The CLCATT shall disclose on the Certificate of Acceptance a valid CLCATT certification. A certification shall be obtained from an approved acceptance certification provider. The CLCATT shall complete all required documentation in accordance with the applicable requirements in Section 10-103(a)4.
Title 24 2013

- Triggered:
  - New construction
  - Additions
  - Alterations
    - >10% fixtures
    - >40 ballasts or luminaires
- “New” Requirements:
  - Acceptance Testing (AT)
  - Commissioning (Cx)
**Players**

- **Design Engineer**
  - Designs to T24
  - Generates Certificates of Compliance (CC)

- **Lighting subcontractor**
  - Installs lighting/controls
  - Fills out Certificates of Installation (CI)

- **General Contractor**
  - Collects CIs, gives to Acceptance Technician
  - Submits AT forms to permitting agency
Players

- **Certified Lighting Controls Acceptance Test Technician (CLCATT)**
  - Certifies documentation
  - Verifies installation certification
  - Completes Acceptance Tests (AT)
    - Indoor
    - Outdoor

- **CALCTP-AT Employer**
  - Quality Assurance program
  - Accurate bids
  - Supports technician education and recertification

1. (T24, Sec 130.4.c) Also: California Advanced Lighting Controls Training Program Acceptance Technician/Tester (CALCTP-AT), Acceptance Test Technician Certification Provider (ATTCP) (CEC)
Process:

Certificate of Compliance
- By design engineer
- Design meets T24

Building permit

Certificate of Installation
- By contractor or installer
- Eqpt installed properly

(Cx Functional Performance Tests)
- Eqpt performs as designed

Acceptance Certificate
- By Acceptance Technician
- Verify installation
- Document performance
- Provide to GC

Certificate of occupancy
Installation Certification

- **Performed by contractor**
  - Automatic daylighting Controls (NA 7.6.1)
  - Shutoff controls (NA 7.6.2)
  - Demand response (NA 7.6.3)
  - Lighting Control System (NA 7.7.1)
  - EMS (NA 7.7.2)
  - Line voltage track lighting
    - integral current limiters (NA 7.7.3)
    - Supplementary overcurrent protection panels (NA 7.7.4)
  - Interlocked lighting (NA 7.7.5)
  - Lighting controls for Power Adjustment Factor (PAF) (NA 7.7.6)
  - Videoconference lighting (NA 7.7.7)
  - Outdoor Lighting Controls (NA 7.8)
Acceptance Testing
Acceptance Testing Process

Plan Review
- Before you go out!
- Know what you’re testing

Construction Inspection
- Before and after install
- Equipment complies with Title 20

Functional Testing
- Verifies performance

Certificate of Occupancy
- Puts teeth into acceptance testing
Acceptance Tests

- Indoor Lighting Controls (NRCA-LTI-02-A)
- Automatic Daylighting Controls (NRCA-LTI-03-A)
- Demand Response Lighting Controls (NRCA-LTI-04-A)
- Outdoor Lighting (NRCA-LTO-02-A)
What’s up with the form names?

NR??-LT?-0?-?

Non-Residential

Lighting

CC = certificate of compliance
CI = certificate of installation
CA = certificate of acceptance

I = Indoor
O = Outdoor

#

A = Acceptance Test
E = Enforcement Agency
Acceptance Tests

- Indoor Lighting Controls (Auto Shutoff) (NRCA-LTI-02-A)
- Automatic Daylighting Controls (NRCA-LTI-03-A)
- Demand Response Lighting Controls (NRCA-LTI-04-A)
- Outdoor Lighting (NRCA-LTO-02-A)
Automatic shut-off
(NRCA-LTI-02-A)

Occupancy Sensor
Automatic Time-Switch
Occupancy sensor

**Inspect**
- Minimize false-on
- >4 ft from diffuser
- No obstructions
- CEC certified (Title 20)
- No audible sound

**Test**
- Occupied
- Unoccupied
- Sensitivity
- Time delay
- Sampling allowed (n>7)
# Automatic time-switch

## Inspect
- Documentation
- Programming
  - Date/time
  - Building schedule
  - Holiday/weekends
- Override
  - <2 hours
- CEC Certified
- Battery backup

## Test
- Is programming correct?
- Lights turn off
- Janitor sweeps
- Lights turn on
- Is documentation present?
## Automatic Daylighting  
(NRCA-LTI-03-A)

<table>
<thead>
<tr>
<th>Inspect</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ Drawings show:</td>
<td>✔ Reference location</td>
</tr>
<tr>
<td>□ Skylit zone</td>
<td>□ No/full/partial daylight tests</td>
</tr>
<tr>
<td>□ Primary sidelit zone</td>
<td>□ Uniformity for stepped switching</td>
</tr>
<tr>
<td>□ Secondary sidelit zone</td>
<td>□ Delay</td>
</tr>
<tr>
<td>□ Type and Location! Location! Location!</td>
<td>□ Sampling allowed for &gt;5 zones</td>
</tr>
<tr>
<td>□ Documentation</td>
<td>□ Not allowed for zones &gt;5000 sq. ft.</td>
</tr>
</tbody>
</table>
## Demand Response (NRCA-LTI-04-A)

<table>
<thead>
<tr>
<th>Inspect</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings &gt;10,000 sq. ft.</td>
<td>Full output test</td>
</tr>
<tr>
<td>Response to a utility request</td>
<td>Minimum output test</td>
</tr>
<tr>
<td>Automatic</td>
<td>Illuminance method</td>
</tr>
<tr>
<td>15%&lt;reduce&lt;50%</td>
<td>Current Method</td>
</tr>
<tr>
<td></td>
<td>Area-weighted calcs</td>
</tr>
<tr>
<td></td>
<td>Sampling allowed (n&gt;7)</td>
</tr>
</tbody>
</table>
Outdoor Lighting Controls
(NRCA-LTO-02-A)
Outdoor Lighting Controls (NRCA-LTO-02-A)

- Independent circuits from indoor lighting
- Photocontrols or Astronomical Time-Switch
- AND
- Motion sensors IF
  - Incandescent >100W
  - <24’ to fixture
  - <=1500W per zone
- AND reduce lighting levels IF:
  - Sales
  - Facades
  - Ornamental hardscape
  - Outdoor dining

Automatic control to reduce lighting based on activity or time
## Outdoor Lighting Controls Testing

<table>
<thead>
<tr>
<th>Motion Sensors</th>
<th>Part-Night Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inspect</strong></td>
<td><strong>Inspection only</strong></td>
</tr>
<tr>
<td>- Drawings</td>
<td>- Circuits</td>
</tr>
<tr>
<td>- Overlap</td>
<td>- Astronomical time clock</td>
</tr>
<tr>
<td>- Obstructions</td>
<td>- Programmable schedules</td>
</tr>
<tr>
<td><strong>Test</strong></td>
<td><strong>Lighting reduction capability</strong></td>
</tr>
<tr>
<td>- Take a walk</td>
<td></td>
</tr>
<tr>
<td>- Observe</td>
<td></td>
</tr>
<tr>
<td>- No sampling!</td>
<td></td>
</tr>
</tbody>
</table>
Final Thoughts

- A lot to chew on
  - Owners
  - Contractors
  - Acceptance Test Technicians
- Compatible with commissioning
- Puts teeth in commissioning
- Energy savings *will* be realized
Questions?

http://kw-engineering.com/resources/presentations/presentations.php
Checklists (next slides)
Prefunctional Testing Checklist

- **Daylight Sensors**
  - Calibration is critical

- **Occupancy sensors**
  - Ideal calibration: after construction complete, on night or weekend
  - Tough to do!
  - On to 50% saves the most energy

Streamline:
Give the contractor the opportunity to use their forms with your addenda. If the form fulfills the intent of your prefunctional testing form, it is good enough
Acceptance Testing Checklist

- **BE PREPARED**
  - Coordinate
  - Tools
  - Prepare test before
  - Be flexible

- **Occupancy Sensors**
  - Test mode, or
  - Trip and walk away
    - Signage
    - Mark forms after leaving
    - Test More
    - Check before times is up
  - Location
  - Sensitivity
  - Delay

- **Photocells/Daylight Sensors**
  - Flashlight/Tape
  - Placement
  - Calibration

- **Fluorescent Ballasts**
  - Anything unusual

- **Illumination Levels**
  - BOD, OPR compliance
  - Sampling

- **Timer Controls and Sequence of Operation**
  - Prepare
  - Coordinate
  - Situational Awareness