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Submitted On: 8/28/2015
Docket Number: 15-BSTD-05

CALCTP Comments on 2016 Nonresidential Compliance Manual Chapter 13 Lighting Control Acceptance Test Requirements

Additional submitted attachment is included below.

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August 27, 2015

VIA EMAIL ONLY

California Energy Commission
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> **Re:** **CALCTP Comments on 2016 Nonresidential Compliance Manual, Chapter 13 Lighting Control Acceptance Test Requirements**

I am writing on behalf of the California Advanced Lighting Control Training Program ("CALCTP") to comment on the proposed 2016 Nonresidential Compliance Manual and related compliance documents. CALCTP is an approved Lighting Control Acceptance Test Technician Certification Provider that has trained and certified well over a thousand Lighting Control Acceptance Test Technicians throughout California. CALCTP will be providing supplemental training to all of its certified Acceptance Test Technicians on the changes to the lighting control acceptance test requirements that are contained in the 2016 Code.

In order to ensure that CALCTP's certification training is consistent with the compliance manual guidance, CALCTP engaged Cori Jackson from the UC-Davis California Lighting Technology Center to review the 2016 Nonresidential Compliance Manual to determine if any corrections, clarifications or additions were needed. Based on this review, Ms. Jackson made the following findings:

1. The summary of new or modified acceptance test requirements for 2016 (Section 13.1) is incomplete. It does not include: (a) the new acceptance test requirements for institutional tuning of lighting controls; (b) the changes to lighting control sampling requirements contained in NA7.6.1.2, NA7.6.2.3

2698-063j

NA7.6.3.2, NA7.8.2; (c) the changes to the lighting control occupancy sensor maximum time-out period requirements; and (d) changes to the weighted area calculation procedure required due to updates in demand response control language.

2. The compliance manual does not include the lighting controls acceptance test procedure for Institutional Tuning, which is newly required under Section 130.4 of the Standards. The compliance documents also fail to include a new acceptance test form for this procedure. The compliance manual should be amended to include this procedure and to provide an acceptance test document to report test results. In addition the nonresidential appendix incorrectly lists the acceptance test for this item under the installation requirements.

3. The compliance manual contains various erroneous statements suggesting that the "responsibilities" of lighting acceptance test technicians include correcting any deficiencies found in the lighting controls. The stated responsibilities should not reference electrical wiring activities, including location or relocation of electric lighting devices or controls. In addition, stated responsibilities should not include requirements to correct deficiencies in any aspect of a lighting control device installation. Only certified electricians are licensed to complete electrical repairs. Lighting control acceptance test technicians, however, are not required to be certified electricians and thus can only be made responsible to complete the acceptance test procedures in order to verify correct functionality of regulated devices, to document deficiencies with respect to acceptance test requirements, and to retest any devices once deficiencies are corrected. Examples of erroneous statements can be found on page 13-12, 13-128, and 13-130.

4. There are several changes or clarifications that have been made to lighting control device requirements in the 2016 Standards that are not included in the compliance manual. For example, maximum time-out period for occupancy sensors has been reduced to 20 minutes, however the 2016 compliance manual includes the 2013 requirement of 30 minutes. As a second example, acceptable dimming range for outdoor luminaires with

controls has changed from 40% to 90%, while the manual still references 2013 requirements of 40-80%. Examples of incorrect reference values can be found on page 13-130, 131, 132, 133, 179, 180 and 184.

5. Sampling procedures for use with outdoor automatic shut off acceptance tests are new and should be detailed in the compliance manual. Sampling procedures for indoor controls should be noted throughout the compliance manual.

6. The 2016 code changes the area included in the compliance calculation for the 15% reduction requirement for demand response controls to exempt spaces with LPD <= 0.5 W/sf. (See Section 130.1(e).) Before the reductions could take place in areas with LPD <=0.5, now those areas cannot be counted toward the reductions. The compliance manual (and the compliance documents) should be updated to indicate this change.

Attached is a marked up document with comments by Ms. Jackson that more specifically identify the above issues and her proposed corrections, along with various formatting, grammatical or reference section errors which should be cleaned up.

CALCTP appreciates the hard work of Commission staff in preparing the compliance manual and compliance documents and hopes that these comments are helpful in facilitating completion of this process. If you have any questions about any of these comments, please let us know.

Sincerely,

Thomas A. Enslow

TAE:ljl
Attachment: Cori Jackson 2016 Nonresidential Compliance Manual, Chapter 13 Markup.

2698-063j

~~Acceptance Test Requirements – Acceptance requirements ensure that equipment, controls and systems operate as required by the Standards. The activities specified in these requirements have three aspects:~~

Page 13-1

13.   Acceptance <u>Test</u> Requirements

~~13.1   Acceptance requirements ensure that equipment, controls and systems operate as required by the Standards. The activities specified in these requirements have three aspects:~~

~~13.2   Visual inspection of the equipment and installation~~

~~13.3   Review of the certification requirements~~

~~13.4   Functional tests of the systems and controls~~

~~13.5~~13.1   New <u>or Modified</u> Acceptance <u>Test</u> Requirements for ~~2013~~<u>2016</u>

A. Building Envelope<u>, §110.6</u>:

- ~~For Fenestration Acceptance (NRCA-ENV-02-F)~~<u>No changes.</u>

B. Mechanical Acceptance Tests<u>, §120.5</u>:

- <u>Thermal Energy Storage (TES) Systems (NRCA-MCH-15-A)</u>
  - o   <u>~~-~~Incorporates new acceptance criteria.</u>
- <u>Minor clarifications:</u>
  - o   <u>Outdoor Air (NRCA-MCH-02-A)</u>
  - o   <u>Supply Water Temperature Reset Controls (NRCA-MCH-09-A)</u>
  - o   <u>Hydronic System Variable Flow Controls (NRCA-MCH-10-A)</u>
  - o   <u>Fault Detection & Diagnostics for DX Units (NRAC-MCH-12-A)</u>
  - o   <u>Automatic Fault Detection & Diagnostic for Air Handling & Zone Terminal Units (NRCA-MCH-13-A)</u>

C. ~~Supply Air Temperature Reset Controls Acceptance (NRCA-MCH-16-A),~~

D. ~~Condenser Water Supply Temperature Reset Controls Acceptance (NRCA-MCH-17-A),~~

E. ~~Energy Management Control System Acceptance (NRCA-MCH-18-A)~~

~~F.~~<u>C.</u>   Lighting <u>Controls</u> Acceptance Tests<u>, §130.4</u>:

- <u>Minor clarifications:</u>
  - o   Outdoor Lighting Acceptance Tests (NRCA-OLT-02-A)

Author: corimj Subject: Highlight   Date: 8/20/2015 9:55:35 AM
Fragment that should deleted or moved and statements completed.

Author: corimj Subject: Sticky Note   Date: 8/20/2015 10:01:36 AM
Changes to Indoor lighting controls requirements that effect systems requiring acceptance tests. For example, demand response controls language has been updated such that the weighted-area calculation procedure completed as part of the acceptance tests has changed.

Author: corimj Subject: Sticky Note   Date: 8/20/2015 10:03:03 AM
New acceptance test requirement for Institutional Tuning PAF

Note: Only the acceptance tests listed in §120.5 and §130.4 may require that the Field Technician be a certified ATT. Other acceptance tests, such as those found in §120.6 do not require that the Field Technician be a certified ATT.

B. Responsible Person

A Certificate of Acceptance must be signed by a ~~licensed~~ *Responsible Person* who is licensed and eligible under Division 3 of the Business and Professions code in the applicable classification, to take responsibility for the scope of work specified by the Certificate of Acceptance. ~~document~~ The *Responsible Person* can also perform the field testing and verification work, and if this is the case, the *Responsible Person* must complete and sign both the Field Technician's signature block and the *Responsible Person's* signature block on the Certificate of Acceptance ~~form~~document. The *Responsible Person* assumes responsibility for the acceptance testing work performed by his Field Technician agent or employee. Aside from being licensed, the *Responsible Person* may also need to be a certified ATT if they are performing an acceptance test that requires completion from a certified ATT.

C. Enforcement Agency

The Certificate of Acceptance must be submitted to the enforcement agency in order to receive the final Certificate of Occupancy. Enforcement agencies shall not release a *final* Certificate of Occupancy unless the submitted Certificate of Acceptance demonstrates that the specified systems and equipment have been shown to be performing in accordance with the applicable acceptance requirements.

The enforcement agency has the authority to require the *Field Technician or Responsible Person* to demonstrate competence, to ~~its~~ their satisfaction.

~~When Are Acceptance Tests Required?~~

~~In general the Acceptance Tests apply to new equipment and systems installed in either new construction or retrofit applications. More detailed notes and any specific exceptions to this rule are noted in the following paragraphs. If an acceptance test is required, the appropriate form along with each specific test must be submitted to the enforcement agency before a final occupancy permit can be granted.~~

~~Envelope Test Procedures:~~

~~NRCA-ENV-02-F: Fenestration Acceptance~~

~~NA7.4.1 Fenestration applies to each fenestration product.~~

~~NA7.4.2 Window Films applies to each window film product.~~

~~NA7.4.3 Dynamic Glazing applies to each dynamic glazing product.~~

~~Mechanical Test Procedures:~~

~~NRCA-MCH-02-A: Outdoor Air Acceptance~~

~~Variable Air Volume Systems Outdoor Air Acceptance~~

~~New Construction and Retrofit: Applies only to new Variable Air Volume (VAV) systems~~

~~Constant Air Volume Systems Outdoor Air Acceptance~~

~~New Construction and Retrofit: Applies only to new Constant Air Volume (CAV) systems~~

~~NRCA-MCH-03-A: Constant Volume, Single Zone, Unitary Air Conditioner and Heat Pump Systems Acceptance – Packaged and Split~~

Page: 8

Author: corimj Subject: Inserted Text Date: 8/20/2015 10:20:07 AM
by

Author: corimj Subject: Sticky Note   Date: 8/20/2015 10:22:11 AM
This should have strong and clear language that states the Enforcement Agency has the responsibility to ensure the ATTs are certified by checking their cert # and that an occupancy permit cannot be granted without that check.

C. *Functional Testing*

A *Field Technician* ~~must take~~assumes responsibility for performing the required acceptance requirements procedures. In some cases the same *Field Technician* may not perform all~~All~~ of the required acceptance tests for a project ~~need not be performed by the same *Field Technician*~~. However, for each acceptance test performed, the *Field Technician* ~~who performs the test~~ is responsible for identifying all performance deficiencies, ==ensuring ~~that they are corrected~~corrective actions,== and if necessary, he must ~~repeat~~ retest the acceptance requirement procedures until the specified systems and equipment are performing in accordance with the acceptance requirements. The *Field Technician* who performs the testing must sign the Certificate of Acceptance to certify the information ~~he has provided to document the results of the acceptance procedures~~ is true and correct.

A ~~licensed contractor, architect, or engineer~~ (*Responsible Person*)~~, who is eligible under Division 3 of the Business and Professions Code in the applicable classification,~~ must ~~take responsibility for~~ensure performance of the scope of work specified by the Certificate of Acceptance, and must review the test results provided by ~~from the acceptance requirement procedures provided by~~ the *Field Technician*~~.~~ The *Responsible Person* must ~~and~~ sign the Certificate of Acceptance ~~to certify compliance with the acceptance requirements. Regardless of who performs the tests, a *Responsible Person* must review the forms and sign off on them~~. The *Responsible Person* may also perform the *Field Technician's* responsibilities, and must then also sign the *Field Technician* declaration on the Certificate of Acceptance ~~to certify that the information on the form is true and correct~~.

~~Certificate of Occupancy~~

~~Enforcement agencies shall not release a final Certificate of Occupancy until all required Certificates of Acceptance are submitted. Copies of all completed, signed Certificates of Acceptance are required to be posted, or made available with the building permit(s) issued for the building, and shall be made available to the enforcement agency for all applicable inspections.~~

D. *~~Forms~~Certification of Acceptance*

==Acceptance test results ~~are documented using a series of forms. These~~ include a Certificate of Acceptance and individual worksheets to assist in field verification.== Table 13-1 (~~The table~~ below) is provided to ~~shows~~ the Certificate of Aacceptance ~~forms~~documents and related references ~~Standards sections~~.

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🔲 Author: corimj Subject: Highlight   Date: 8/20/2015 10:32:38 AM
This is NOT the responsibility of the ATT. They identify and document deficiences, then retest once corrective action is taken. An ATT may also make some corrections, if possible, but its not a requirement. In fact, many corrective actions may require an electrician and ATTs are not that.

🔲 Author: corimj Subject: Highlight   Date: 8/20/2015 10:33:52 AM
you don't retest a procedure....

i would put back to repeat

🗨 Author: corimj Subject: Sticky Note   Date: 8/20/2015 10:36:03 AM
Should repeat the statement that if the Responsible person acts as the Field Technician they may also require certification as an ATT.

🔲 Author: corimj Subject: Highlight   Date: 8/20/2015 10:38:30 AM
Test results do not include forms. They are documented on forms. This sentence makes no sense.

Mechanical	NRCA-MCH-14-A – Distributed Energy Storage DX AC Systems Acceptance	§120.5(a)13	NA7.5.13
	NRCA-MCH-15-A – Thermal Energy Storage (TES) System Acceptance	§120.5(a)14	NA7.5.14
	NRCA-MCH-16-A – Supply Air Temperature Reset Controls Acceptance	§140.4(f), 120.5(a)15	NA7.5.15
	NRCA-MCH-17-A – Condenser Water Supply Temperature Reset Controls Acceptance	Not required per standards. However, this test is required if this control strategy is implemented.	NA7.5.16
	NRCA-MCH-18-A – Energy Management Control System Acceptance	§110.2(e), §120.2(h), §120.5(a)17, §130.4(b), §130.5(f), §150.0(k)	--------
Indoor Lighting	NRCA-LTI-02-A – Lighting Controls	§110.9(b), §130.1(c)	NA7.6.2, 6.3 and 6.4
	NRCA-LTI-03-A –Automatic Daylighting Controls	§130.1(d)	NA7.6.1
	NRCA-LTI-04-A–Demand Responsive Lighting Controls	§130.1(e)	NA7.6.3
Outdoor Lighting	NRCA-OLTLTO-02-A – Outdoor Lighting Acceptance Tests	§110.9(b), §130.2(a & c)	NA7.6.1, NA7.7.1 and 7.7.2NA7.8
Process	NRCA-PRC-01-AF – Compressed Air System Acceptance	§120.6(e)	NA7.13
	NRCA-PRC-02-AF – Commercial Kitchen Exhaust	§140.9(b)	NA7.11
	NRCA-PRC-03-F – Parking Garage Exhaust	§120.6(c)	NA7.12
	NRCA-PRC-04-AF – Refrigerated Warehouse – Evaporator Fan Motor Controls Acceptance	§120.6(a)3	NA7.10.2
	NRCA-PRC-05-AF – Refrigerated Warehouse – Evaporative Condenser Controls Acceptance	§120.6(a)4	NA7.10.3.1
	NRCA-PRC-06-AF – Refrigerated Warehouse – Air-Cooled Condenser Controls Acceptance	§120.6(a)4	NA7.10.3.2
	NRCA-PRC-07-AF – Refrigerated Warehouse – Compressor Variable Speed Acceptance	§120.6(a)5	NA7.10.4
	NRCA-PRC-08-AF – Refrigerated Warehouse – Electric Resistance Underslab Heating System Acceptance	§120.6(a)2	NA.7.10.1
	NRCA-PRC-12-F – Elevator Lighting and Ventilation Controls	§120.6(f)5	NA7.14
	NRCA-PRC-13-F – Escalator and Moving Walkways Speed Control	§120.6(g)2	NA7.15

E. Submission of Certification of Acceptance

The completed and signed Certificate of Acceptance must be submitted to the local building department is accordance with the local laws, ordinances, regulations or customs. There is no general requirement for a Certificate of Acceptance to be submitted to any other regulatory agency or to an Acceptance Test Technician Certification Provider unless specific contractual agreements require such

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T Author: corimj Subject: Highlight   Date: 8/20/2015 10:39:02 AM
Need to add form for institutional tuning PAF

•13.1.5   Lighting Acceptance Testing Overview

Acceptance requirements can effectively improve code compliance and help determine whether, ~~lighting equipment meets operational goals and~~ or if, efficiency and effectiveness need to ~~whether it should be adjusted to increase efficiency and effectiveness.~~

~~Administrative Regulations~~

~~*§10-103(b)*~~

Administrative Requirements

The administrative requirements contained in the Standards (§-10-103(b)) require ~~the lighting plans and specifications to contain~~:

- ~~-~~Completed acceptance testing ~~forms~~documents for automatic daylighting controls, manual ~~daylight switching, occupant sensing devices~~ and automatic shut-off controls.
- ~~-Record drawings are provided to the building owners within 90 days of receiving a final occupancy permit.~~
- ~~-~~Operating and maintenance information be provided to the building owner.
- ~~-~~Requirement for the issuance of installation certificates for daylighting controls, occupant sensing devices and automatic shut-off controls.

Example:

~~The plans and specifications would require automatic shut-off lighting controls. A construction inspection would verify the device location and wiring is complete. Acceptance tests would verify proper zoning, on-off functions and overrides to assure the shut-off system is properly functioning. Owners' manuals and maintenance information would be prepared for delivery to the building owner. Finally, record drawing information, including programming information for the automatic shut-off lighting controls must be submitted to the building owner within 90 days of the issuance of a final occupancy permit.~~

Constructability Plan Review

~~Although acceptance testing does not require a plan review to be performed by the construction team, the construction team should review the construction drawings and specifications to understand the scope of the acceptance tests and raise critical issues that might affect the success of the acceptance tests prior to starting construction. Any constructability issues associated with the lighting system should be forwarded to the design team so that necessary modifications can be made prior to equipment procurement and installation. As an example, understanding the construction inspection requirements for manual or automatic daylighting controls (NA7.6.3 and NA7.6.1) could prevent expensive rewiring if the circuiting requirements are understood prior to installing the wiring.~~

~~Field Process~~

Construction Inspection

~~"Do it right the first time." It is better to check that the wiring plan complies with the acceptance test requirements before installation. The alternative may result in the wiring not passing the construction acceptance test and rewiring.~~

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Author: corimj Subject: Inserted Text Date: 8/20/2015 10:43:56 AM
regulated

Author: corimj Subject: Inserted Text Date: 8/20/2015 10:44:10 AM
its

Author: corimj Subject: Sticky Note   Date: 8/20/2015 11:19:12 AM
not sure why they call out acceptance and installation specifically and exclude compliance certificates. These are the ones that ATs need to reference to see what AT tests are needed.

Author: corimj Subject: Cross-Out   Date: 8/20/2015 10:53:03 AM

Author: corimj Subject: Cross-Out   Date: 8/20/2015 10:54:39 AM
this is an automatic shut off control, no reason to list it separately.

Author: corimj Subject: Sticky Note   Date: 8/20/2015 10:54:03 AM
no manual daylight switching, add demand response and institutional tuning

Author: corimj Subject: Highlight   Date: 8/20/2015 11:16:58 AM
This is not specified in Section 10-103 (b)

Author: corimj Subject: Inserted Text Date: 8/20/2015 11:16:34 AM
Completed

Construction inspection should occur while wiring is installed. If changes have to be made to circuiting, it is better to do this while a lift is still on site or before obstructions are installed.

Key circuiting issues are:

Wiring for multi-level control. Lamps, luminaires or rows of luminaires are regularly assigned to different circuits so that light levels can be increased uniformly by switching

Lighting in the daylit zone has to be on separate circuits from other lighting and, in most cases, must also be wiring for multi-level control.

Construction inspection should also identify:

Lighting control devices are properly located, calibrated and setpoints or schedules established,

Documentation is available to identify settings and programs for each device.

Testing is to be performed on the following devices:

Automatic daylighting controls

Manual daylighting controls

Occupancy sensing devices, and

Automatic shut-off controls

13.1.5.1   Lighting Acceptance Test Issues

Tailor aAcceptance testing must be tailored for each specific design, job site, and/or climatic conditions. While the steps for conducting each test remain consistent, the application of the tests to a particular site may vary. The following section discusses some of the known issues that occur when the acceptance tests are applied to a project.

A. Internal control delays

Be aware of the potential for delays programmed into many control sequences. The purpose of delays is to prevent the system from controlling too rapidly and becoming unstable. With delays between 5 to 30 minutes, the acceptance testing can be prolonged considerably.

B. Initial conditions

Each test instructs the contractor to return the systems to normal operating condition based on the initial schedules, setpoints, and control parameters. These should be recorded prior to initiating the testing process.

C. Obtain correct control sequences before testing

Before testing begins, It is essential to know exactly how the control sequences are programmed before testing begins. Otherwise, the contractor will not be able to customize the test to the particular systems or verify that the systems work as intended. Written control sequences often do not include enough detail to test the system against, or they are found to be incorrect. Testing based on incorrect sequences will not necessarily yield a valid result. In addition, to be successful, the contractor will need to know how to manipulate the control system.

D. Estimated Time to Complete

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Author: corimj Subject: Highlight   Date: 8/20/2015 10:48:27 AM
These statements should match the Mechanical section. Mechanical section was rewritten, but this one wasn't.

Author: corimj Subject: Highlight   Date: 8/20/2015 10:51:55 AM
This whole thing needs to be rewritten. The first sentence speaks to an implied "YOU" as in "you" need to know. then it switches the subject to the contractor. Its confusing.

EMCS:

- Verify the control graphics represent the system configuration
- Verify control points are properly mapped to the graphics screen
- Raise and lower a sampling of space temperature setpoints in the software and verify the system responds appropriately
- Verify the time-of-day start-up and shut-down function initiates a proper system response
- Verify trending capabilities by establishing trend logs for a sampling of control points
- Verify alarm conditions are monitored
- Verify the EMCS panel is installed on an emergency power circuit or has adequate battery back-up

*E.*C.   *Test Procedures for Indoor & Outdoor Lighting*Functional Testing

This section includes test and verification procedures for lighting systems that require acceptance testing as listed below:.

Form Document *NRCA-LTI-03-A*

- NA 7.6.1 Automatic Daylighting Controls Acceptance

Form Document *NRCA-LTI-02-A*

- NA 7.6.62.2 and 7.6.62.3 Occupant sensor Acceptance
- NA 7.6.62.4 and 7.6.62.5 Automatic Time Switch Control Acceptance

Form Document *NRCA-LTI-04-A*

- NA 7.6.7 3 Demand Responsive Controls

Form Document *NRCA-OLT-02-A*

- NA 7.7.17.8.1.2 Outdoor Motion Sensor Acceptance
- NA 7.78.2 Outdoor Lighting Shut-off Controls

13.22   NA7.6.2 Shut-off Controls Acceptance

NA7.6.2.2 and NA7.6.2.3 Occupancy Sensing Lighting Controls Acceptance

At-A-Glance

Occupant sensor Acceptance
Use Document NRCA-LTI-02-A
Purpose of the Test
The purpose of the test is to ensure that occupant sensors are located, adjusted, and wired properly to achieve the desired lighting control. There are two basic technologies in three configurations utilized in most occupant sensors: 1) infrared; 2) ultrasonic (passive or active);

and 3) a combination of infrared and ultrasonic.

Occupant sensors are used to automatically turn lights ON immediately when a space is occupied, and automatically turn them OFF when the space is vacated after a pre-set time delay. Some sensors are configured so the user must manually switch the lights ON but the sensor will automatically switch the lights OFF (manual-ON controls). These are commonly called 'vacancy sensors' and are included in this testing procedure. Automated lighting controls prevent energy waste from unnecessarily lighting an unoccupied space.

Instrumentation

This test verifies the functionality of installed occupant sensors visually and does not require special instrumentation.

Test Conditions

Occupant sensors are installed properly and located in places that avoid obstructions and minimize false signals.

All luminaires are wired and powered.

During the test, the space remains unoccupied.

Document the initial conditions before overrides or manipulation of the BAS. All systems must be returned to normal at the end of the test.

Estimated Time to Complete

Construction Inspection: 0.25 to 0.5 hours (depending on visual and audible inspection requirements)

Equipment Test: 0.5 to 1 hours (depending on necessity to adjust time delay or mask sensor to prevent false triggers)

Acceptance Criteria

Standard occupant sensor responds to "typical" occupant movement to turn the lights ON immediately.

Manual ON occupant sensor requires occupant to switch lighting on.

Multi-level occupant sensors meet uniformity requirements; the first stage activates between 30-70 percent of the lighting power; after that event the occupant has the ability to manually activate the alternate set of lights, activate 100 percent of the lighting, and deactivate all of the lights.

Conditions where partial ON/OFF controls are required in addition to or instead of the basic controls requirements are identified and the controls properly reduce lighting power by at least 50 percent.

Ultrasonic occupant sensors do not emit audible sound.

Lights controlled by the occupant sensor turn OFF when the preset time delay is met.

The maximum time delay is not greater than 30 minutes.

Occupant sensor does not trigger a false ON or OFF.

Status indicator or annunciator operates correctly.

Potential Issues and Cautions

It is imperative that the test be performed during a time when the tester can have full control over the occupancy of the space.

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Author: corimj Subject: Cross-Out   Date: 8/20/2015 11:46:18 AM

Author: corimj Subject: Cross-Out   Date: 8/20/2015 11:48:23 AM

Author: corimj Subject: Inserted Text Date: 8/20/2015 11:48:03 AM
after the space becomes vacant and

Author: corimj Subject: Inserted Text Date: 8/20/2015 11:48:20 AM
period expires.

Author: corimj Subject: Cross-Out   Date: 8/20/2015 11:48:41 AM
20

The time delay can be adjusted to minimize test time, but the time delay setting must be reset upon completion of the test (not to exceed ~~30 minutes~~).

~~Plan sensor location to avoid detection~~ of significant air movement from an HVAC diffuser or other source, which can cause the sensor to turn the lights ON (this is most critical with ultrasonic sensors).

~~Avoid detection of motion in adjacent areas and unwanted triggers by adjusting coverage pattern intensity or masking the sensor with an opaque material.~~

~~Educating the owner about furniture and partition placement in the spaces can avoid future problems with infrared sensor performance (which rely on "line-of-sight" coverage).~~

A. *Test Comments*

Newly Constructed and Additions/Alterations: Applies to Occupant sensor, Acceptance Manual Daylight Controls Acceptance, and Automatic Time Switch Control Acceptance Functional Testing and verification is required.

The purpose of the test is to ensure that an occupant sensor is ~~located, adjusted, and wired properly to achieve the desired lighting control.~~ Occupant sensors are used to automatically turn lights on and keep them on when a space is occupied, and turn them off automatically when the space is unoccupied after a reasonable time delay. The time delay, typically adjustable, will prevent lights from rapid cycling through ON and OFF when spaces are occupied and ~~unoccupied~~ frequently. It also helps avoid false OFF triggering when there is little apparent occupant movement. ~~There are two basic technologies in three configurations utilized in most occupant sensors: 1) infrared; 2) ultrasonic (passive or active); and 3) a combination of infrared and ultrasonic detection.~~

B. *Construction Inspection*

Verify the following:

* Occupant sensors are not located within four feet of any HVAC diffuser.
* ~~Occupant sensors can sometimes trigger by heavy air flow.~~
* Ultrasonic occupant sensors do not emit audible sound 5 feet from source.
* Ultrasonic sensors should not emit audible sound. As the name implies, ultrasonic sensors emit ultrasonic sound waves at frequencies that should be imperceptible to the human ear. Ensure the sensor does not emit any sounds that ARE audible to the human ear at typical occupant location.
* Occupant sensors have been certified to the Energy Commission in accordance with the applicable provision in §110.9. Verify that model numbers of all occupant sensors are listed on the Energy Commission database as "Certified Appliances & Control Devices" (http://www.energy.ca.gov/appliances/database/).

C. *Functional Testing*

a. **Part 1: Occupant sensor**

Step 1: Simulate an unoccupied condition.

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Author: corimj Subject: Cross-Out   Date: 8/20/2015 11:49:35 AM
20

Author: corimj Subject: Cross-Out   Date: 8/20/2015 11:50:32 AM
AT cannot plan the location. AT can verify that the sensor is located per the requirements which is not less than 4' from an HVAC diffuser

Author: corimj Subject: Highlight   Date: 8/20/2015 11:53:41 AM
These really have nothing to do with the ATs issues/concerns/responsibiliteis. They should be struck from this section. Or at least rewritten to be an "if" statement....with a recommendations. For example, If motion is detected from unwanted areas, recommend that sensor location be adjusted or sensor detection area be masked with an opaque material.

Author: corimj Subject: Highlight   Date: 8/20/2015 11:54:52 AM
What?

This needs to be rewritten. Not sure what they are trying to say here.

Author: corimj Subject: Inserted Text Date: 8/20/2015 11:55:24 AM
functions. see previous comment on this issue.

Author: corimj Subject: Inserted Text Date: 8/20/2015 11:56:09 AM
vacated

Author: corimj Subject: Cross-Out   Date: 8/20/2015 11:57:48 AM
This is already stated previously. Eliminate redundant text.

Author: corimj Subject: Highlight   Date: 8/20/2015 12:03:14 PM
There are five things specifically called out in the code (NA 7.6.2.2) for construction inspection. The list here should match those. It doesn't.

Author: corimj Subject: Cross-Out   Date: 8/20/2015 11:58:49 AM
Verify that occupant sensor can sometimes be trigger by air flow???

Author: corimj Subject: Highlight   Date: 8/20/2015 12:00:55 PM
Indent if an "explanation" is needed here.
Same for statement that "occupant sensors can sometimes be triggered by heavy air flow. Should not be on the same bulleted level as the things that must be verified.

Author: corimj Subject: Highlight   Date: 8/20/2015 12:06:44 PM
Add a few sentences on the sampling size requirements.

Ensure the space being tested remains unoccupied during the test and wait for the lights to turn off (sensor delay time can be adjusted to shorten test time).

Verify and Document

1. Lights controlled by the occupant sensor turn off when the time delay is met. If the time delay was not adjusted prior to the test, ensure the maximum delay is not greater than 30 minutes. If the time delay was adjusted to minimize test time, ensure the sensor time delay setting does not exceed 30 minutes.

2. Occupant sensor does not trigger a false ON. Ensure that any movement outside the desired control zone does not activate the lights. Examples include:

   - Walking past an open door of an enclosed office

   - Walking in an adjacent zone close to the control zone, (consider that designers sometimes employ overlapping sensor coverage areas as part of the design)

   - Movement other than occupants (i.e. air flow from HVAC system or furnishing movement due to external forces)

Step 2: For a representative sample of building spaces, simulate an occupied condition.

Verify and Document

   - Status indicator or annunciator operates correctly.

   - Most occupant sensors have an LED that will illuminate (typically flash) when motion is detected, where others may emit an audible sound.

   - The lights in the control zone turn on immediately.

   - Except if the sensor has "manual-ON" capability. The occupant sensors that are required to have "manual-ON" capability are identified on the Lighting Control Worksheet.

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Author: corimj Subject: Inserted Text Date: 8/20/2015 12:04:49 PM
period expires.

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:04:03 PM
20

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:05:12 PM
20

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:07:35 PM
return the time delay to initial conditions or no more than 20 minutes, whichever is less.

Author: corimj Subject: Cross-Out   Date: 8/20/2015 12:09:55 PM
Do not include this. The requirements include a provision that ultrasonic not emit audible sound. There is no benefit to adding this statement.

Author: corimj Subject: Highlight   Date: 8/20/2015 12:11:03 PM
These should be combined into one "bullet"

b. **Part 2: Partial Off Occupant sensor**

Step 1: Simulate an unoccupied condition.

Verify and Document:

1. Lights controlled by the occupant sensor turn off when the time delay is met. If the time delay was not adjusted prior to the test, ensure the maximum delay is not greater than 30 minutes. If the time delay was adjusted to minimize test time, ensure the sensor time delay setting does not exceed 30 minutes.

2. Occupant sensor does not trigger a false ON. Ensure that any movement outside the desired control zone does not activate the lights. Examples include:

    • Walking past the end of the aisle or book stack

    • Walking in an adjacent zone close to the control zone, (consider that designers sometimes employ overlapping sensor coverage areas as part of the design, so ensure that the zone coverage test has a reasonable demarcation)

    • Movement other than occupants (i.e. air flow from HVAC system or furnishing movement due to external forces)

3. In the partial off state, lighting shall consume no more than 50% of installed lighting power, or:

    • No more than 60% of installed lighting power for metal halide or high pressure sodium lighting in warehouses.

    • No more than 60% of installed lighting power for corridors and stairwells in which the installed lighting power is 80 percent or less of the value allowed under the Area Category Method.

Light level may be used as a proxy for lighting power when measurements are taken.

Step 2: Simulate an occupied condition

Verify and document:

The occupant sensing controls turn lights fully ON in each separately controlled areas, Immediately upon an occupied condition

c. **Part 3: Partial On Occupant sensor**

Step 1: Simulate an occupied condition.

Simulate a situation where an occupant enters a space with a partial on sensor arrangement.

Verify and Document

    • The occupant sensor will activate the first stage of lighting, between 30 to 70% of the total lighting connected load for the specific lighting equipment controlled.

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Author: corimj Subject: Highlight   Date: 8/20/2015 12:44:08 PM
Should be written as "Partial-OFF" per definitions contained in Section 100.1

Author: corimj Subject: Highlight   Date: 8/20/2015 12:13:39 PM

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:13:56 PM
period expires.

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:14:15 PM
20

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:14:45 PM
is returned to initial conditions or 20 minutes, whichever is less.

Author: corimj Subject: Highlight   Date: 8/20/2015 12:21:10 PM
Noted exceptions are incorrect as written. Multiple exception are not included.
 See 130.1(c)6 and 130.1(c)7.

Author: corimj Subject: Highlight   Date: 8/20/2015 12:43:34 PM
should be written as "Partial-ON" per the definitions contained in Section 100.1.

Author: corimj Subject: Highlight   Date: 8/20/2015 12:28:53 PM
The only requirement in the code for Partial ON is 50-70%, and if that control is used you don't need the multi-level steps, which is where this 30% is coming from. See section 130.1 (c) 5. A.

- After the first stage occurs, manual switches are provided to activate ~~and deactivate~~ the alternate set of lights~~, bringing the total power consumption up to the full connected load of the controlled lighting equipment~~, deactive the alternate set of lights or deactive the entire connected load.

Step 2: Simulate an unoccupied condition.

Verify and Document

- Both stages of lighting (automatic and manual stages) turn OFF with a maximum of 30 minute delay from the beginning of the unoccupied condition.

- Occupant sensor does not trigger a false ON. Ensure that any movement outside the desired control zone or HVAC operation does not activate the lights.

d. **Part 4: Occupant Sensor Serving Small Zones in Large Open Office Plan For Power Adjustment Factor (PAF)**

For each controlled zone that is being tested, first complete Functional Test 2 (Occupant Sensor) to confirm that the sensor is switching the lights on and off as required. Then enter the information described below:

- Area served by controlled lighting (square feet) - Size of the controlled zone, which is to say the zone underneath the lighting controlled by this occupant sensor. The boundaries of the controlled zone should lie halfway between one light fixture and the next, if the light fixtures are on a regular grid.

- Enter PAF corresponding to controlled area - From line (a) on the test form, enter the power adjustment factor that corresponds to the size of the controlled zone (~~<125sf for PAF=0.4,~~ 126-250sf for PAF=0.3, 251-500sf for PAF=0.2).

- Enter PAF claimed for occupant sensor control in this space from compliance documentation - ~~Simply enter the~~ PAF for this controlled zone, from the Certificate of Compliance

- The PAF corresponding to the controlled area (line b), is less than or equal to the PAF claimed in the compliance documentation (line c) - This step is to ensure that the PAF being claimed in the acceptance test is not ~~more~~ less than the PAF that was claimed for the same zone on the compliance document.

- Sensors shall not trigger in response to movement in adjacent walkways or workspaces. The sensor switches on the lights only in response to movement within the group of workspace(s) that together constitute the controlled area. The lights must not trigger in response to movement in nearby areas.

- All steps are conducted in Functional Test 2 "Occupancy Sensor (On Off Control)" and all answers are Yes (Y) - This step verifies that Functional Test 2 has been conducted, to verify that the occupant sensor switches the lights between their high and low states as required.

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Author: corimj Subject: Cross-Out   Date: 8/20/2015 12:29:52 PM

Author: corimj Subject: Cross-Out   Date: 8/20/2015 12:29:57 PM

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:30:59 PM
, deactive the alternate set of lights or deactive the entire connected load.

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:31:41 PM

in

Author: corimj Subject: Cross-Out   Date: 8/20/2015 12:31:33 PM

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:31:23 PM
20

Author: corimj Subject: Highlight   Date: 8/20/2015 12:47:22 PM
should be less than or equal to

Author: corimj Subject: Cross-Out   Date: 8/20/2015 12:47:49 PM

Author: corimj Subject: Cross-Out   Date: 8/20/2015 12:48:15 PM

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:51:11 PM
less

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:49:29 PM
calculated during

NA7.6.2.4 and NA7.6.2.5 Automatic Time Switch Lighting Controls Acceptance

At-A-Glance

Automatic Time Switch Acceptance

Use Document NRCA-LTI-02-A

Purpose of the Test

This test ensures all non-exempt lights, per §130.1(c)1, are automatically turned off at a predetermined time and individual lighting circuits can be manually enabled, if necessary, during scheduled OFF periods (i.e., a lighting "sweep").

~~An automated control to turn off,~~ lighting during typically unoccupied periods ~~of time~~ prevents energy waste.

Instrumentation

This test verifies the functionality of installed automatic time switch controls visually and does not require special instrumentation.

Test Conditions

All luminaires and override switches controlled by the time switch control system must be wired and powered.

Lighting control system must be installed and ready for system operation, including completion of all start-up procedures, per manufacturer's recommendations.

Document the initial conditions before overrides or manipulation of the BAS. All systems must be returned to normal at the end of the test.

Estimated Time to Complete

Construction Inspection: 0.5 to 2 hours (depending on familiarity with lighting control programming language)

Equipment Test: 2 to 6 hours (depending on familiarity with lighting control programming language, number of lighting circuits and override switches to be tested, and programmed time delays between ON and OFF signals)

Acceptance Criteria

Automatic time switch controls are programmed with acceptable weekday, weekend, and holiday schedules, per building occupancy profile.

The correct date and time are properly set in the lighting controller.

Program backup capabilities ~~preventing~~ the loss of the device's schedules for at least 7 days, and the device's time and date setting for at least 72 hours, if power is interrupted

All lights may be either turned ON manually or turned ON automatically during the occupied time schedule.

All lights turn OFF at the ~~preprogrammed,~~ scheduled times.

The manual override switch is functional and turns associated lights ON when activated.

Override time limit is no more than 2 hours, except for spaces exempt per §131(c)3.B.

If annunciator is installed, verify proper installation. Verify the annunciator warning to the occupants that the lights are about to turn OFF functions correctly.

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Author: corimj Subject: Cross-Out   Date: 8/20/2015 12:52:48 PM
unnecessary

Author: corimj Subject: Cross-Out   Date: 8/20/2015 12:53:29 PM

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:53:20 PM
Automated controls that extinguish

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:55:53 PM
are present to prevent

Author: corimj Subject: Cross-Out   Date: 8/20/2015 12:56:24 PM

Author: corimj Subject: Inserted Text Date: 8/20/2015 12:57:08 PM
automatically

Ensure that ~~occupant sensors have been certified~~ to the Energy Commission in accordance with the applicable provision in §110.9. Verify that model numbers of all ~~occupant sensors~~ are listed on the Energy Commission database as "Certified Appliances & Control Devices."

http://www.energy.ca.gov/appliances/database/

Potential Issues and Cautions

The manual override time limit can be adjusted to minimize test time, but the time limit setting must be reset upon completion of the test (not to exceed 2 hours).

When possible, perform the test when the spaces are unoccupied. Turning ~~the lights OFF~~ when other occupants are present can cause problems and ~~unsafe working conditions.~~

A. Test Comments

==Newly Constructed and Additions/Alterations: Applies to Occupant sensor, Acceptance Manual Daylight Controls Acceptance, and Automatic Time Switch Control Acceptance. Functional testing and verification is required.==

B. Construction Inspection

1. Verify automatic time switch controls are programmed with acceptable weekday, weekend, and holiday schedules. Non-exempt lights should be scheduled OFF a reasonable time after the space is typically unoccupied (i.e., 1 or 2 hours after most people ~~have already left~~ the space).

2. Verify schedule and other programming parameter documentation ~~was provided to the owner.~~ The documentation should include weekday, weekend, and holiday schedules as well as sweep frequency and/or override time period.

3. Verify correct date and time is properly set in the time switch. Lights will not be controlled correctly if the programmed date and time do not match actual values.

4. Verify the battery is installed and energized. The device shall have program backup capabilities that prevent the loss of schedules for at least 7 days, and the time and date settings for at least 72 hours if power is interrupted.

5. Override time limit is no more than 2 hours. When the lights are switched off, each lighting circuit can be turned back on manually. Most systems will either send out another OFF signal through the entire lighting network to command all lights back off, or an override timer will expire to turn off the lights which were manually turned on. Regardless of the control strategy, lights that were manually turned ON during an OFF period should only be operating for up to 2 hours before they are automatically turned off again.

6. Verify that override switch is readily accessible and located so that a person using the device can see the lights being controlled--for example, individual override switch per enclosed office or centrally located switch when serving an open office space.

7. Verify that model numbers of all automatic time switch controls are listed on the Energy Commission database as "Certified Appliances & Control Devices." http://www.energy.ca.gov/appliances/database/

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Author: corimj Subject: Inserted Text Date: 8/20/2015 1:01:23 PM
automatic time switches

Author: corimj Subject: Inserted Text Date: 8/20/2015 1:01:39 PM
automatic time switches

Author: corimj Subject: Highlight   Date: 8/20/2015 1:02:31 PM
Makes no sense. Need to be rewritten...

Author: corimj Subject: Inserted Text Date: 8/20/2015 1:03:03 PM
vacate

Author: corimj Subject: Inserted Text Date: 8/20/2015 1:03:59 PM
is available or posted for the owner.

C. Functional Testing

Step 1: Simulate occupied condition.

Set ON time schedule to include actual time or adjust time to be within the ON time schedule (whichever is easier).

Verify and Document

Verify all lights can be enabled. Some systems may turn the lights on automatically at the scheduled time, but others may require that lights be turned on manually using their respective area control switch.

Step 2: Simulate unoccupied condition.

Set the OFF time schedule to include the actual time, or adjust the time to be within the OFF time schedule (whichever is easier).

Verify and Document

All non-exempt lights turn off. Most systems warn occupants that the lights are about to turn off by sending a pulse through the lighting circuits to "flicker" the lights or provide another form of visual or audible annunciation.

Manual override switch is functional. Enabling the manual override switch allows only the lights in the selected space where the switch is located to turn ON. This is particularly important in enclosed spaces to ensure only lights within the enclosed space are controlled, however, switches serving open spaces should also control only lights in the designated zone. The lights should remain ON throughout the override time period (refer to §130.1(c)3B for maximum override times) and the system indicates that the lights are about to be turned off again.

All non-exempt lights turn off when the next OFF signal is supplied to the lighting control circuits or the override time has expired. In order to reduce testing time associated with the complete OFF-Manual override-OFF sequence, the override time may be shortened so that the entire sequence can be witnessed within a reasonable amount of time.

The device has program backup capabilities that prevent the loss of schedules for at least 7 days, and the loss of time and date setting for at least 72 hours if power is interrupted.

Step 3: Return system back to normal operating condition.

Ensure all schedules, setpoints, operating conditions, and control parameters are placed back at their initial conditions. Ensure the override time period is no more than 2 hours.

It is also good practice to leave a schedule in the timeclock itself for easy reference and to leave a blank schedule form so that the users can document any schedule changes.

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Author: corimj Subject: Cross-Out   Date: 8/20/2015 1:08:59 PM
Already did this as part of the construction inspection.

~~13.25~~13.23 NA7.6.1 Automatic Daylighting Control Acceptance

At-A-Glance

Automatic Daylighting Control Acceptance
Use ~~Form~~ Document NRCA-LTI-03-A

Purpose of the Test

The purpose of this test is to ensure that spaces mandated to have automatic daylighting control (refer to §130.1(d)) are installed and functioning as required by the Standards.

Automatic daylighting controls in Primary Sidelit and Skylit Daylit Zones are mandatory if the zone includes more than 120 Watts of lighting equipment. The lighting must have multiple stages of control that meet the requirements of Table 130.1-A and §130.1(d)2Dii. Automatic daylighting controls in Secondary Sidelit Zones are prescriptive and ~~its~~§140.6(d) outlines their functions.

Benefits of the Test

The controls save energy only if they are functioning correctly. Controls passing the test provide adequate illuminance under all daylight conditions while reducing lighting power ~~enough~~ in response to daylight in the space to save a significant fraction of lighting energy. If the control leaves the space too dark, visual quality is compromised and ultimately the control will be over-ridden resulting in no energy savings. If the control leaves lights on at too high ~~an~~ ~~illuminance~~ level, the full savings from the control are not realized.

Instrumentation

To perform the test, it will be necessary to measure ambient light levels and validate overall power reduction. In most cases, the only instrumentation required is:

- Light meter (illuminance or foot-candle meter)

For dimming ballasts, a default illuminance/power relationship can be used to estimate power consumption.

Alternatively, the tester can choose to directly measure power or current or use the manufacturer's dimming performance data. Additional instrumentation or data that may be needed:

- Hand-held amperage meter or power meter

- Logging light meter or power meter

- Manufacturer's light versus power curve for continuous dimming and step dimming ballasts

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Author: corimj Subject: Cross-Out   Date: 8/20/2015 1:10:18 PM

Author: corimj Subject: Inserted Text Date: 8/20/2015 1:10:55 PM
a

Test Conditions

All luminaires in the Daylit Zone must be wired and powered. Controls installed according to manufacturer's instructions

Simulating a bright condition can be difficult; therefore, performing the test under natural sunny conditions is preferable.

Document the initial conditions before testing. All systems must be returned to normal at the end of the test.

Estimated Time to Complete

Construction Inspection: 0.5 to 1 hour (depending on whether sensor calibration is necessary, familiarity with lighting control programming language, and availability of construction documentation – i.e. electrical drawings, material cut sheets, etc.)

Equipment Test: 1 to 3 hours (depending on ability to manipulate ambient light levels, familiarity with lighting control programming language, and method employed for verifying required power reduction)

Acceptance Criteria

Lighting is correctly circuited so that general lighting fixtures in the Daylit Zone are on the automatic daylighting controlled circuit and lighting outside of the Daylit Zone is not on the controlled circuit. [§130.1(d)2A]

Photosensor has been located properly to minimize unauthorized tampering. [§130.1(d)2Di]

The photosensor is physically separated from the location where calibration adjustments are made, or is capable of being calibrated in a manner that the person initiating calibration is remote from the sensor during calibration to avoid influencing calibration accuracy. [§110.9(b)2]

Sensor located and oriented appropriate to the control type and location of Daylit Zone.

Under conditions where no daylight is sensed by the control, the control system increases the light output of each fixture to the design light output. This may be full output, but in a space with multi-level lighting requirements, this could be commissioned to meet the design illuminance requirements.

The controlled fixtures reduce lighting power to no greater than 35 percent of full-load power under fully dimmed and/or stepped conditions. [§130.1(d)2Div]

For the continuous and stepped dimming control systems, the lamps do not "flicker" at reduced light output. [§110.9(b)3], which cites the Title 20 requirements for dimming. Title 20, Section 1605.3(l)2(F)2 states, "*Dimmer controls that can directly control lamps shall provide electrical outputs to lamps for reduced flicker operation through the dimming range…without causing premature lamp failure.*" Because there is no standard for evaluating flicker, this is intended to refer to visible flicker.

Automatic daylighting systems shall provide multi-level control capability following the guidance in Table 130.1-A. [§130.1(d)2Dii]

Stepped dimming and stepped switching control systems have a minimum time delay of 3 minutes or greater before a decrease in electric lighting. [§110.9(b)2]

For the stepped dimming and stepped switching control systems, the deadband between steps is sufficiently large to prevent cycling between steps for the same daylight illuminance.

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with digital systems, the concept of a "circuit" no longer apply. This needs to be made clear here. Something like, "Lighting is correctly controlled so that general lighting fixtures in the Daylit Zone are controlled separately from lighting outside the Daylit zone."

Verify that the setpoints, settings and programming on each of the control system device has been documented and provided by the installer.

Step 5: Daylit Zone Circuiting

Verify that the luminaires in the Daylit Zone are controlled separately from those outside the Daylit Zone. Further, verify that the luminaires in ~~daylighted~~ daylit areas near windows are circuited separately from the luminaires in ~~daylighted~~ daylit areas under skylights. Verify the correct Daylit Zone category for luminaires following the spacing requirements stated in the above sections. The Skylit Daylit Zone takes top priority in situations where Daylit Zones overlap, then Primary Sidelit, and finally, Secondary Sidelit.

Step 6: Daylighting Control Device Certification

Verify that installed daylighting controls have been certified to the Energy Commission in accordance with the applicable provisions of §110.9:

- Automatic Daylighting Control Devices

- Interior Photosensors

Verify that model numbers of all daylighting controls are listed on the Energy Commission database as "Certified Appliances & Control Devices."

http://www.energy.ca.gov/appliances/database/

~~B.~~C.   Functional ~~Performance~~ Testing

- There are two separate functional performance tests that are specific to the type of control being tested. The first test is suitable for continuous dimming systems and the second test is for step dimming or step switching controls.

- Continuous dimming controls are controls that alter the output of lamps in at least 10 steps.

- Step dimming controls alter the output of lamps in less than 10 steps (typically up to four steps between on and off).

- Step switching controls turns lamps or groups of lamps on and off without any steps between on and off.

- Stepped switching controls are able to provide multi-level lighting by having more than one group of lamps being controlled. Partial light output (and partial power consumption) of the stepped switching lighting system is provided by turning some of the lamps on.

The tests for stepped switching and stepped dimming controls are combined as the discrete steps of light output render them sufficiently similar for functional testing.

Note: Many of the steps in these acceptance tests can be conducted while setting up the controls according to manufacturer's instructions. Read these tests prior to conducting equipment set-up and bring the ~~forms~~documents along while conducting set-up. This way you can conduct the equipment set-up and perform the acceptance test at the same time.

Sampled functional performance testing of systems smaller than 5,000 ft²

All photocontrols serving a Daylit Zone more than 5,000 ft² shall undergo functional testing. Photocontrols that are serving Daylit Zones less than 5,000 ft² are allowed to be tested on a sampled basis. The sampling rules are as follows:

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T Author: corimj Subject: Highlight   Date: 8/20/2015 1:21:27 PM
Separate circuiting is not a requirement and not necessary with digital systems

Area-Weighting Calculations

The area-weighting calculations required by the functional test are simple, though the equation on the ~~forms~~documents is complicated. An example is given below.

The following measurements were taken in a building, for the full output test. For convenience, all the daylight measurements are zero.

Lines a and c have been omitted for clarity		Space number		
		1	2	3
b.	Take one illuminance measurement at a representative location in each space, using an illuminance meter.	30 fc	35 fc	40 fc
d.	Take one illuminance measurement at the same locations as above, with the electric lighting system in the demand response condition.	15 fc	20 fc	40 fc
e.	Turn off the electric lighting and measure the daylighting at the same location (if present)	0 fc	0 fc	0 fc
f.	Calculate the reduction in illuminance in the demand response condition, compared with the design full output condition. [((line b - line e)- (line d – line e)) /(line b - line e)]	50%	43%	0%
g.	Note the area of each controlled space	2000 sf	800 sf	1300 sf
h.	The area-weighted reduction must be at least 0.15 (15%) but must not reduce the combined illuminance from electric light and daylight to less than 50% of the design illuminance in any individual space.	$\dfrac{\{(50\% \times 2000) + (43\% \times 800) + (0\% \times 1300)\}}{2000 + 800 + 1300}$ = 8.3%……so the space complies.		

~~13.29~~13.25 (NA7.8) Outdoor Lighting Shut-off Controls

At-A-Glance

NA7.8 Outdoor Lighting Shut-off Controls
Use ~~Form~~ Document NRCA-LTO-02-A

Purpose of the Test

The purpose of these test~~s~~ is to ensure that all outdoor lighting regulated by ~~§~~130.2(c)~~1 is automatically turned off during daytime~~ , is additionally ~~controlled on a time schedule during night-time hours, and that lights subject to §130.2(c)3 are controlled by a bi-level time switch control, or a motion sensor.~~ are automatically turned off during daytime and are controlled by a motion sensor, photocontrol, astronomical time-switch control, part-night outdoor lighting control or automatic scheduling control, as required.

~~For outdoor lighting regulated by §130.2(c)3 (lighting of building facades, parking lots, sales and non-sales canopies, all outdoor sales areas, and student pick-up/drop off zones) the time switch controls are configured to do both of the following: 1) scheduling controls to automatically turn off all the lighting, and 2) scheduling controls to automatically reduce applicable lighting power by 40 to 80 percent. A motion sensor is an acceptable alternative to the bi-level time sweep controls.~~

Benefits of the Tests

Automated controls to turn off outdoor lighting during daytime hours, and when not needed during nighttime hours, prevent energy waste.

Instrumentation

This test verifies the functionality of installed automatic controls visually and does not require special instrumentation.

Test Conditions

All outdoor luminaires must be wired and powered.

Lighting control system must be installed and ready for system operation, including completion of all start-up procedures, per manufacturer's recommendations.

Estimated Time to Complete

Construction Inspection: 0.5 to 2 hours (depending on familiarity with lighting control programming language)

Equipment Test: 0.5 to 2 hours (depending on familiarity with lighting control programming language, number of lighting circuits to be tested)

Acceptance Criteria

Lights turn off when daylight is available.

Automatic time switch controls turn off the lighting when not needed at night

Motion sensors reduce lighting power by at least 40 percent but not exceeding 80 percent.

The correct date and time are properly set in the lighting controllers.

==Astronomical time switch controls and automatic time switch controls have been certified to the Energy Commission in accordance with the applicable provision in §110.9. Verify that model numbers of all such controls are listed on the Energy Commission database as "Certified Appliances & Control Devices."==

http://www.energy.ca.gov/appliances/database/

   A. Test Comments

Newly Constructed and Additions/Alterations: Applies to functional testing and verification of motion sensor location and ensures the sensor coverage is not blocked by obstruction.

Verifies the sensor signal sensitivity is adequate.

Verifies the outdoor lighting shut-off control during daytime hours.

-Verifies the astronomical and standard shutoff controls are programmed for weekdays, weekends and holiday schedules.

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Author: corimj Subject: Inserted Text Date: 8/20/2015 1:35:47 PM
90

Author: corimj Subject: Highlight   Date: 8/20/2015 1:36:15 PM

Author: corimj Subject: Inserted Text Date: 8/20/2015 1:36:23 PM

And motion sensors

NA7.8.1.~~2~~ ~~– Outdoor~~ and NA 7.8.2 Motion Sensor ~~Acceptance~~

Note: The motion sensor must be installed in conjunction with a photocontrol or astronomical time switch that automatically turns off the outdoor lighting when daylight is available.

A.B.*   *Construction Inspection

~~Ensure that~~Prior to Functional testing, verify and document:

- Motion sensor has been located to minimize false signals

- Sensor is not triggered by motion outside of adjacent area. Desired motion sensor coverage is not blocked by obstruction that could adversely affect performance.

- Desired sensor coverage is not blocked by obstructions that could adversely affect performance.

B.C.*   *Functional T~~t~~esting

Test conditions: Simulate or provide conditions so that outdoor photocontrol or astronomical time switch ~~is in night time mode and is otherwise turning lights ON~~.

Simulate motion in area under lights controlled by the ~~motion~~ sensor.

Verify and document ~~the following~~:

- Status indicator operates correctly.

- Lights controlled by motion sensors turn on immediately upon entry into the area lit by the controlled lights near the motion sensor

- Signal sensitivity is adequate to achieve desired control

Simulate no motion in area with lighting controlled by the sensor ~~but with motion adjacent to this area~~.

Verify and document ~~the following~~:

- Lights controlled by motion sensors turn off within a maximum of ~~30~~ minutes from the start of an unoccupied condition per §110.9(b).

- The occupant sensor does not trigger a false "on" from movement outside of the controlled area

- Signal sensitivity is adequate to achieve desired control.

~~NA7.8.2 – Outdoor Lighting Shut-Off Controls~~

~~Construction Inspection~~

~~All installed outdoor lighting shall be controlled by a photocontrol or outdoor astronomical time-switch control that automatically turns OFF the outdoor lighting when daylight is available, per §Section 130.2(c)1. All outdoor lighting shall also be controlled by an automatic scheduling control that automatically turns OFF the~~

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Author: corimj Subject: Sticky Note   Date: 8/20/2015 1:41:17 PM
Should include a few sentences on new sampling procedure allowed by 2016 code

Author: corimj Subject: Inserted Text Date: 8/20/2015 1:39:00 PM
allows lights to be ON.

Author: corimj Subject: Inserted Text Date: 8/20/2015 1:45:15 PM
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