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ENERGY COMMISSION

STAFF REPORT

Staff Recommendations for the 2022 Energy Code

Acceptance Test Technician Certification Provider Program

Gavin Newsom, Governor
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California Energy Commission

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ABSTRACT

The California Energy Commission (CEC) updates the California Building Energy Efficiency Standards (Energy Code) on a three-year cycle. The *2022 California Building Energy Efficiency Standards* will go into effect January 1, 2023 (for building permit applications submitted on or after the effective date). Staff prepared this report to seek public input on recommendations for the *2022 California Building Energy Efficiency Standards* related to the acceptance test technician certification provider program and acceptance testing requirements. The staff recommendations include:

- A requirement for each acceptance test technician certification provider to implement a database system for tracking acceptance tests performed by certified acceptance test technicians.
- An overhaul of Reference Nonresidential Appendix NA7.
- Minor editorial changes.

Staff will present these recommendations at a noticed public workshop and will consider all comments.

Keywords: Acceptance testing, acceptance test technician, acceptance test employer, acceptance test technician certification provider, mechanical systems, lighting controls, Building Energy Efficiency Standards, Energy Code

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EXECUTIVE SUMMARY

The California Energy Commission updates the California Building Energy Efficiency Standards on a three-year cycle. The standards contain energy and water efficiency requirements (and indoor air quality requirements) for newly constructed buildings, additions to existing buildings, and alterations to existing buildings. The *2022 California Building Energy Efficiency Standards* will continue to improve upon the *2019 California Building Energy Efficiency Standards* for newly constructed, additions, and alterations to residential and nonresidential buildings. The *2022 California Building Energy Efficiency Standards* will go into effect on January 1, 2023 (for building permit applications submitted on or after the effective date).

Staff prepared this report to seek public input on recommendations for the *2022 California Building Energy Efficiency Standards* related to the acceptance test technician certification provider program and acceptance testing requirements. Acceptance test technicians perform required tests for lighting controls and mechanical systems in nonresidential buildings. The California Energy Commission's approved acceptance test technician certification providers train, certify, and oversee technicians and employers. This report does not include all changes staff may be considering for the *2022 California Building Energy Efficiency Standards* affecting the acceptance test technician certification provider program.

Staff will present the recommendations contained in this report at a noticed public workshop and consider all comments.

CHAPTER 1: Introduction

The California Energy Commission (CEC) updates the Building Energy Efficiency Standards (Energy Code) on a three-year cycle. The 2022 Energy Code will continue to improve upon the 2019 Energy Code for newly constructed, additions, and alterations to residential and nonresidential buildings. The 2022 Energy Code will go into effect January 1, 2023 (for building permit applications submitted on or after the effective date).

CEC staff prepared this report to seek public input on recommendations for the 2022 Energy Code related to the acceptance test technician certification provider (ATTCP) program, acceptance testing within the scope of the ATTCP program. This report does not include all changes that staff may be considering for the 2022 Energy Code that may affect the ATTCP program. This report presents recommendations for existing issues within the ATTCP program as of the 2019 Energy Code.

As of July 1, 2014, certified lighting control acceptance test technicians (LC-ATT) must perform acceptance testing for lighting controls. Uncertified technicians can perform acceptance testing for mechanical systems, but this situation may change. A certified mechanical ATT (M-ATT) will be mandatory for mechanical acceptance testing after the CEC finds that the threshold requirements[1] have been satisfied.

The staff recommendations include a requirement for each ATTCP to implement a database system for tracking acceptance tests performed by certified acceptance test technicians (ATT) (Chapter 2), an overhaul of the lighting controls acceptance testing sections in Reference Nonresidential Appendix NA7 (Chapter 3), and other minor editorial changes.

1 For the CEC to make it mandatory for only certified M-ATTs to perform the required mechanical acceptance testing, the CEC must determine that there are at least 300 certified M-ATTs statewide (§10-103.2[b]1A), and eligible professions have reasonable access to the requisite training to become a certified M-ATT (§10-103.2[b]2).

CHAPTER 2:
Recommendations for the ATTCP Program

Introduction

The CEC developed the ATTCP program to improve compliance with lighting controls and mechanical systems acceptance test requirements. The ATTCP program provides training, certification, and oversight of ATTs who perform the acceptance tests required by the Energy Code, as well as the acceptance test employers (ATEs) that employ ATTs. ATTCPs are professional organizations approved by the CEC to provide training curricula for ATTs and ATEs, certification procedures, complaint resolution (including disciplinary procedures), quality assurance, and accountability measures.

Staff includes two categories of recommendations for all ATTCPs in this chapter.

1. Database requirements for all ATTCPs
2. Minor editorial recommendations for §10-103.1 and §10-103.2

Database Requirement for All ATTCPs

Issue Statement

The CEC is required to verify that the programs it puts in place are for the public benefit, enhance or enable compliance with the Energy Code, result in greater energy savings, and are cost-effective.[2] The database systems implemented by the ATTCPs can provide staff with part of the necessary information to evaluate the ATTCP program.

Staff does not have unrestricted access to the database systems developed by each of the lighting controls and mechanical ATTCPs. Lack of unrestricted access to the database systems developed by each of the lighting controls and mechanical ATTCPs prevents staff from effectively evaluating the overall performance of the ATTCP program such as compliance with the Energy Code (quality assurance in particular), public benefits, and quantifying the program energy savings. Therefore, CEC staff is proposing updates to the ATTCP program that would allow CEC to access electronic databases created and maintained by the ATTCPs.

Background

ATTCPs have voluntarily implemented database systems to support quality assurance programs. While there are subtle differences between the quality assurance requirements for lighting controls and mechanical ATTCPs, the goals are the same. The ATTCP screens the data input from the ATT for data type and range (if applicable). One percent (or more) of all

2. Public Resources Code §25301(a) and (b)3 of the California Code of Regulations allow staff to conduct assessments to evaluate CEC energy programs. Public Resources Code §25401 and §25401(b) allow staff to conduct technical assessments to reduce wasteful, inefficient, unnecessary, and uneconomic uses of energy.

acceptance tests performed by each ATT is subject to paper auditing, and an additional 1 percent (or more) is subject to on-site auditing. A paper audit is a review of all relevant submitted acceptance tests for a project compared to other projects (submitted by the ATT as well as those submitted by other ATTs), as well as compared to the project plans submitted to the authority having jurisdiction (AHJ) (if they are available). An on-site audit entails reviewing the construction inspection and functional test of each acceptance test for a project site and correlating that test to the actual installation.

Moreover, each ATTCP uses its database system to monetize the ongoing acceptance testing process. Union-based ATTCPs do not charge ATTs for using its database (they generally rely on union fees), but they have arranged the database system to potentially charge ATTs for each compliance document that they use. Nonunion ATTCPs charge the ATTs for each compliance document that they use.

Recommended Language Changes

Although these requirements may appear to be similar to the requirements for a data registry (Reference Joint Appendix JA7), they in no way should be construed to mean that the database system requirements construes compliance with the requirements in JA7 or that the database system may be referred to as a data registry, which is reserved for those systems that do comply with JA7.

New Sections 10-103.1(c)3H and 10-103.2(c)3H.

H. The ATTCP shall maintain, or by suitable contractual requirements cause to be maintained, an electronic database approved by the CEC. The electronic database shall be capable of all the following:

(i) Support all activities for the ATTCP to comply with its quality assurance program as required by §10-103.1(c)3F (or §10-103.2[c]3F).

(ii) For no less than five years, record and preserve all certificates of acceptance offered for certification by the ATTCP and as performed by its own certified ATTs.

(iii) Allow the downloading of electronic copies of each completed certificate of acceptance to the ATT that performed the test, the ATE associated with that ATT, or both.

a. Each page of each certificate of acceptance shall bear the logo of the ATTCP or other identifying insignia as approved by the CEC.
b. The electronic copy shall be capable of being printed.
c. The ATTCP may apply to the CEC for approval to use alternative compliance documents that differ from those approved for use by the CEC but must demonstrate that these alternative compliance documents do not differ in format, informational order, or content from the CEC-approved compliance documents.

(iv) Provide a means of verifying any certificate of acceptance to the enforcement agency having jurisdiction as identified on the certificate of acceptance.

(v) Provide the CEC access to the electronic database with the authority to inspect and securely download all records.

(vi) Provide all summary reports as requested by the CEC.

a. Summary reports shall include all the following elements:

i. The date range of the summary reports shall be customizable.

ii. The range of specificity of summary reports for authorities having jurisdiction shall be from a single authority to all authorities in California.

iii. The summary reports shall include a range of acceptance tests performed from one acceptance test to all acceptance tests.

Justification

The CEC must be authorized to approve the electronic database to ensure that it complies with the proposed requirements, provides the necessary support to the ATTCP to perform all required activities for its quality assurance program, and does not significantly impede compliance with the Energy Code.

Title 24, Part 1, §10-103.1(c)3F and §10-103.2(c)3F requires the ATTCP to develop a quality assurance program that must meet specific goals to ensure that the certified ATTs are performing the acceptance testing properly, accurately, and without evasion of the Energy Code. The electronic database is an integral part of the existing quality assurance programs and must continue to provide this necessary support.

To be able to assess the effectiveness of the ATTCP program, CEC staff must be able to access a sufficient history of acceptance testing for each certified ATT. This access will enable staff to investigate and verify the abilities of individual ATTs, as well as the ATTCP program. Staff chose five years as a reasonable time frame to validate trends that staff might discover.

To enforce the Energy Code, AHJs need to verify that the ATT performing the required acceptance test is certified and the acceptance test was performed under the watch of the ATTCP quality assurance program. To enable this enforcement, the ATTCP must provide an acceptance test compliance document with a CEC-approved logo (or watermark) on each page to the ATT or the associated ATE for submission to the AHJ. The new requirements will ensure that the ATTCP electronic database allows the ATT or ATE to print paper copies or provide electronic copies of the acceptance test forms as required by the AHJ.

To guard against the possibility of a falsified acceptance test compliance document, the AHJ must be allowed to access the ATTCP electronic database to verify the authenticity of the compliance documents.

CEC staff must be allowed access to the ATTCP electronic database to review submitted acceptance tests for trends and issues. Furthermore, staff must be able to transfer part or all

of the electronic database to allow staff to evaluate the ATTCP program for compliance with the Energy Code, public benefits, and effective energy savings.

The ATTCP must provide reports from the electronic database at the request of CEC staff for evaluation and publication of the program activities and effectiveness.

Consequences of Not Making Changes

ATTCPs implement database systems voluntarily and with no regulatory requirement to share that information with CEC staff. Staff enjoys a good working relationship with the ATTCPs and can access any data upon request. However, such relationships between regulatory agencies to the entities they regulate are the exception and not the rule. Therefore, without these changes, staff may lose access to data within the ATTCP electronic database.

Costs and Cost Effectiveness

The ATTCPs implement database systems consistent with these proposed requirements. Therefore, there are no additional costs to industry, AHJs, or the public associated with this proposal.

The 2022 Energy Code energy efficiency improvements assume a 100 percent compliance rate with the Energy Code. Therefore, this proposal will not result in any additional energy efficiencies beyond those assumed for compliance with the 2022 Energy Code. However, 100 percent compliance with the Energy Code has never been proven or supported as a reasonable estimate of the real-world compliance rate.[3] This proposal may result in greater real-world compliance with the 2022 Energy Code by giving staff a valuable enforcement tool to regulate ATTCP and ATT/ATE activities. With better enforcement, increased compliance rates may follow, potentially resulting in fully realized energy efficiency savings.

Potential Impacts

Since the ATTCPs implement database systems consistent with these proposed requirements, this proposal should have no discernable impact on industry, local governments, or the public.

Further Information Needed

In the future, the CEC may approve a nonresidential data registry that will interact with each ATTCP electronic database or possibly replace them entirely. CEC staff is considering an exception to the proposed language in §10-103.1(c)3H and §10-103.2(c)3H that would exempt the electronic database requirement entirely if the ATTCP relies exclusively on the nonresidential data registry.

Minor Editorial Recommendations for Section 10-103.1 and

3 California Energy Efficiency Strategic Plan January, 2011 Update, D.10-09-047 (link: http://docs.cpuc.ca.gov/ PublishedDocs/WORD_PDF/ FINAL_DECISION/123970.PDF).

Section 10-103.2

Issue Statement

There are various editorial issues with §10-103.1 and §10-103.2 of the Energy Code.

Recommended Language Changes

Staff recommends the following minor changes to §10-103.1 and §10-103.2 to correct grammatical errors, clarify meaning, or generally clean up otherwise confusing language.

§10-103.1(c)3A and §10-103.2(c)3A:

> **ATT Training Scope.**

§10-103.1(c)3E and §10-103.2(c)3E:

> The ATTCP shall describe in its applications to the CEC procedures for revoking ~~their~~its certification of ATTs and ATEs based upon ...

§10-103.1(c)3Fi and §10-103.2(c)3Fi:

> The ATTCP shall include quality assurance and accountability measures, including but not limited to independent oversight of the certification materials, processes, and procedures; visits to building sites where certified technicians are completing the acceptance tests; certification process evaluations; building department surveys to determine acceptance testing effectiveness; and expert review of the training curricula developed for ~~Building Energy Efficiency Standards,~~ Section 130.4.

§10-103.1(d)1A and §10-103.2(d)1A:

> A summary of the certification services provided over the reporting period, including the total number of ~~Acceptance Test Technicians~~ATTs and ~~Employers~~ATEs certified by the ATTCP during the reporting period and to date.

§10-103.1(d)1B:

> A summary of all actions taken against any ATT or ATE as a result of the complaint or quality assurance procedures described by the ATTCP as required under Section 10-103.1(c)~~(3)(D)~~ and 10-103.1(c)~~(3)(F)~~.

§10-103.2(d)1B:

> A summary of all actions taken against any ATT or ATE as a result of the complaint or quality assurance procedures described by the ATTCP as required under Section 10-103.2(c)~~(3)(D)~~ and 10-103.2(c)~~(3)(F)~~.

§10-103.1(d)2 and §10-103.2(d)2:

> … The ATTCP shall report to the CEC what application amendments are proposed~~,~~ to address …

§10-103.1(d) and §10-103.2(d):

…~~All required reports shall contain a signed certification that the ATTCP has met all requirements for this program.~~

Justification

These proposed minor editorial changes would serve as clarification, simplification, and general cleanup.

Consequences of Not Making Changes

For the most part, there would be no consequences if these recommended minor editorial changes are not made as the intent of the requirements is the same either way. However, if the recommended changes to §10-103.1(c)3Fi and §10-103.2(c)3Fi are not made, it is possible that interested parties may misinterpret the intent of the requirements as a result of punctuation that was incorrectly revised for the 2019 Energy Code. This possible misinterpretation is more of a concern for any new ATTCP applicants, since existing ATTCPs are already implementing quality assurance and accountability measures that comply with the original intent of §10-103.1(c)3Fi or §10-103.2(c)3Fi.

Costs and Cost Effectiveness

There are no additional costs to parties involved in the ATTCP program, industry, AHJs, or the public associated with these recommended changes.

Potential Impacts

These recommended minor editorial changes would have no discernable impact on parties involved in the ATTCP program, industry, AHJs, or the public.

Further Information Needed

No further information is needed for these recommended minor editorial changes.

CHAPTER 3:
Recommendations for the Lighting Controls Acceptance Testing Requirements

Introduction

The lighting controls acceptance testing procedures in Reference Nonresidential Appendix NA7 need revisions in terms of content, organization, and formatting. There are high-level issues that need to be addressed to ensure that acceptance testing serves the intended purpose of ensuring that estimated energy savings are fully realized:

- For the most part, the construction inspections are either too vague, are redundant to the functional testing, or contain items that must be done during functional testing and cannot be verified by visual inspection before functional testing.
- The functional testing procedures do not capture everything that should be tested to determine if the required lighting controls meet the Energy Code. There are steps that are unclear, need expansion, or are inaccurate, off-base, or both.

Each acceptance test should be reviewed in detail to determine specific improvements to the procedures. Input will be needed from the ATTCPs, ATTs, and ATEs on what issues are seen during acceptance testing, when documenting results, and during audits to develop a comprehensive list of issues and propose revisions in response to the input. Improving the acceptance testing procedures will help to ensure that the acceptance tests are serving the intended purpose and not adding obstacles to the process.

The following sections of this chapter will discuss staff's initial list of issues and recommendations based on staff's review of the requirements and previous input from the ATTCPs. The initial analysis for each major recommendation is grouped by the type of lighting controls acceptance test, and the last main section is dedicated to recurring minor issues found throughout multiple acceptance test procedures. All the draft language that staff has prepared in underline and strikethrough format for the recommendations in this chapter are in Appendix B of this report. Staff has not prepared draft language for every recommendation as staff would like stakeholder input first in some cases. For each recommendation in the subsequent sections of this chapter, staff provides the page numbers for where the draft language is in Appendix B or indicates no draft language exists yet (if applicable).

Shut-off Lighting Controls Acceptance Tests

Align the Occupant Sensing Control Construction Inspection with the Energy Code

Issue Statement

The items in the occupant sensing control construction inspection are not based on the requirements in the Energy Code except for NA7.6.2.2(e).

Background
The requirements in the acceptance testing procedures should be based on the criteria set forth in the Energy Code and should not introduce new requirements. The construction inspection should consist of targeted visual inspections and verification that the installation is complete in preparation for functional testing.

Recommended Language Changes
Staff recommends that the CEC revise the construction inspection to include only items required by the Energy Code or necessary to confirm the lighting controls are ready for functional testing. Staff has not developed draft recommended language yet as stakeholder input is needed. Any changes shown in underline and strikethrough format for the occupant sensing lighting controls construction inspection in Appendix B to this report are part of staff's cleanup recommendations. (See "NA7.6.2 Clean-Up Recommendations" section for more information.)

Justification
The acceptance testing procedures in NA7 should only include requirements that are supported by the Energy Code. In many cases, the changes made to the Energy Code in past code cycles were not reflected in NA7, and the clear link between the two has become degraded. These changes are an effort to reestablish those links and make clear that the construction inspection procedures in NA7.6.2.2 are supported by the requirements in the Energy Code.

Consequences of Not Making Changes
There are no consequences if these changes are not made. The ATTs would continue to follow procedures as described in NA7 that are not clearly aligned with the Energy Code. The issue would be the continued ambiguity of compliance and enforcement with Energy Code requirements.

Costs and Cost-Effectiveness
The proposed changes would not create a new test or impose requirements that affect existing industry practices or cost-effectiveness analyses. These changes would improve existing procedural requirements and clarify the compliance and enforcement of the Energy Code requirements.

Potential Impacts
If the recommended changes are made, the following are potential minor effects:

- The shut-off lighting controls acceptance compliance document (NRCA-LTI-02-A) would need to be updated to reflect the revised construction inspection requirements.
- The ATTCPs would need to update training materials to reflect the revised construction inspection requirements and the NRCA-LTI-02-A.
- The ATTs and ATEs would need to be trained on the requirements and compliance document changes.

Further Information Needed

Staff would like to hear stakeholders' suggestions for how to improve the construction inspection requirements. The construction inspection requirements are meant to be limited to items that can be visually inspected before functional testing.

Expand NA7.6.2.3 to Include Acceptance Requirements for Each Type of Occupant Sensing Control

Issue Statement

There are four types of occupant sensing controls that are defined in the Energy Code: occupant, partial-on, partial-off, and vacancy sensors. The current occupant sensing controls acceptance test procedures in NA7.6.2.3 are mostly specific to occupant sensors and do not address partial-on or partial-off occupant sensors, though there is one step that addresses vacancy sensors.

Recommended Language Changes

Expand the occupant sensing control acceptance test to include requirements to test each type of occupant sensing control. Staff's draft language recommendations are on pages B-7 and B-8 in Appendix B. In the draft language, the occupant sensing control functional testing requirements are in NA7.6.2.1.2 instead of NA7.6.2.3 as part of staff's recommendation to restructure certain sections in NA7.6.

Justification

The 2016 shut-off lighting controls acceptance compliance document included separate sections for the testing of occupant, partial-on, partial-off, and vacancy sensors. However, the compliance document procedures were not supported by NA7.6.2.3. Therefore, the 2019 version of the compliance document had to be corrected to follow the approach supported by the NA7.6.2.3 procedures. Occupant sensors are only one type of occupant sensing control, and the acceptance testing procedures should address all four types of controls that may be used to comply with the applicable Energy Code requirements.

Consequences of Not Making Changes

The current acceptance test procedures in NA7.6.2.3 do not adequately reflect the options for compliance with the Energy Code requirements for lighting controls. As a result, the commercial lighting industry and AHJs are hampered by an inadequate acceptance test procedure and compliance documentation. Changes to the functional testing requirements are necessary to address this deficiency and support compliance and enforcement efforts.

Costs and Cost-Effectiveness

The recommended changes to the occupant sensing control acceptance test requirements will reflect and support current industry and enforcement practices. There will be no additional costs associated with the recommended changes. There may be cost reductions in terms of clarifying the compliance options that may lead to a minor streamlining of inspection approvals and potential improvement of construction timelines.

Potential Impacts

If the recommended changes are made, the following are potential minor effects:

- The shut-off lighting controls acceptance compliance document (NRCA-LTI-02-A) would need to be updated to reflect the revised acceptance testing requirements.
- The ATTCPs would need to update training materials to reflect the revised acceptance testing requirements and the compliance document.
- The ATTs and ATEs would need to be trained on the requirements and compliance document changes.

Further Information Needed

Staff would like to hear if stakeholders agree with staff's recommendations or have any other suggestions for improving the acceptance test requirements in NA7.6.2.3. One alternative to staff's recommendations is to break up NA7.6.2 into subsections for the functional testing of each type of occupant sensing control.

NA7.6.2 Cleanup Recommendations

Issue Statement

There are various minor issues with the grammar, punctuation, structure, consistency, and wording of the procedures in NA7.6.2.

Recommended Language Changes

Staff's draft recommended language changes to NA7.6.2 to address minor issues are on pages B-6 through B-9 of Appendix B.

Justification

These proposed minor changes would clean up minor issues with the grammar, punctuation, structure, consistency, and wording of the procedures in NA7.6.2.

Consequences of Not Making Changes

There would be no consequences if these recommended minor changes were not made, though the CEC would be missing an opportunity to make changes that would improve the quality of the procedures.

Costs and Cost-Effectiveness

There are no additional costs to parties involved in the ATTCP program, industry, AHJs, or the public associated with these recommended changes.

Potential Impacts

These recommended minor editorial changes would have no discernable effect on parties involved in the ATTCP program, industry, AHJs, or the public.

Further Information Needed

No further information is needed for these recommended minor cleanup changes, though staff welcomes feedback from stakeholders.

Automatic Daylighting Controls Acceptance Test

Align the Construction Inspection with the Energy Code

Issue Statement

The automatic daylighting controls construction inspection consists of general language that the controls comply with applicable requirements in §130.1(d) without providing any further details about which requirements are applicable for the construction inspection.

Background

The requirements in the acceptance testing procedures should be based on the criteria set forth in the Energy Code and should not introduce requirements that are not present in the Energy Code. The construction inspection should consist of targeted visual inspections and verification that the installation is complete in preparation for functional testing.

Given that the language in NA7.6.1.1 consists of a general statement that refers to §130.1(d), staff revised the 2019 automatic daylighting controls acceptance compliance document (NRCA-LTI-03-A) to include specific requirements from §130.1(d) that are appropriate for a construction inspection.

Recommended Language Changes

Revise the construction inspection to include only items required by the Energy Code. Staff's draft recommended language changes to NA7.6.1.1 are on page B-1 in Appendix B. The recommended language is based on the 2019 NRCA-LTI-03-A revisions staff has already made.

Justification

The acceptance testing procedures in NA7 should be revised to be straightforward and directly incorporate the specific requirements found in the Energy Code. Replacing nonspecific phrases, such as "applicable requirements," will avoid the need for interpretations and guesswork by the AHJs. Staff has already revised the general construction inspection requirements on the 2019 NRCA-LTI-03-A by including procedures that are required by the Energy Code but not directly specified in NA7.6.1.1.

Consequences of Not Making Changes

There are no consequences if these changes are not made, although continued ambiguity of compliance and enforcement with Energy Code requirements may persist. Staff would need to continue to making interpretations of how to apply NA7.6.1.1 in the NRCA-LTI-03-A, and the ATTs would continue to rely on the NRCA-LTI-03-A more than the NA7 procedures because of the lack of specificity in NA7.

Costs and Cost-Effectiveness

The proposed changes would not create a new test or impose requirements that affect existing industry practices or cost-effectiveness analyses. These changes would improve existing procedural requirements and clarify the compliance and enforcement of the Energy Code requirements.

Potential Impacts

If the recommended changes are made, the ATTCPs would need to update certification training materials to reflect the revised construction inspection requirements. The ATTCPs would also need to include the changes in recertification trainings, but existing ATTs and ATEs would already be familiar with the execution of the revised construction inspection from using the 2019 NRCA-LTI-03-A (on which the recommended changes are based). The NRCA-LTI-03-A would require minimal changes, if any, depending on whether additional changes are adopted beyond the recommended language changes.

Further Information Needed

Staff would like to hear if stakeholders have any suggestions for improving the construction inspection requirements. The construction inspection requirements are meant to be limited to items that can be visually inspected before functional testing.

Add Daylighting Dimming Plus Off-Power Adjustment Factor (PAF) Check to the Stepped Switching/Dimming Functional Testing Requirements

Issue Statement

The functional testing procedures for stepped switching/dimming control systems in NA7.6.1.2.1 are missing a check for the daylight dimming plus off-power adjustment factor (PAF).

Background

The automatic daylighting controls acceptance testing requirements include two sets of functional testing procedures — one for continuous dimming control systems and another for stepped dimming/switching control systems. For the most part, the Energy Code requirements for daylighting controls are the same for the various control system types. However, the testing procedures may vary slightly for each.

After confirming the intent of the regulations is to include the PAF check in both sets of functional testing procedures and consulting with existing ATTCPs on the potential effects, staff revised the 2019 NRCA-LTI-03-A to include the missing step in the stepped dimming/switching section of the document.

Recommended Language Changes

Add the same verbiage from the corresponding step in the continuous dimming control systems functional testing procedures in NA7.6.1.2.2. Staff's draft language is on page B-5 of Appendix B.

Justification

While the testing procedures will vary slightly based on the control strategy, there are key items that the ATTs should be testing regardless of the control strategy. The daylight dimming plus off PAF could be claimed for automatic daylighting controls using any of the allowed control strategies, so both sets of functional testing procedures should require the ATT to verify the daylight dimming plus off capability if the PAF is claimed.

Consequences of Not Making Changes

There are no consequences if these changes are not made. The issue would be the continued ambiguity of compliance and enforcement with Energy Code requirements.

Costs and Cost-Effectiveness

The proposed changes would not create a new test or impose requirements that affect existing industry practices or cost-effectiveness analyses. These changes would improve existing procedural requirements and clarify the compliance and enforcement of the Energy Code requirements.

Potential Impacts

If the recommended changes are made, the ATTCPs would need to update certification training materials to reflect the revised functional testing requirements. The ATTCPs would also need to include the changes in recertification trainings, but existing ATTs and ATEs would already be familiar with the execution of the revised functional test from using the 2019 NRCA-LTI-03-A. The NRCA-LTI-03-A would require minimal changes, if any, depending on whether additional changes are adopted beyond the recommended language changes.

Further Information Needed

Staff would like to hear if stakeholders agree with staff's recommendation or have any additional related input.

Specify That Acceptance Testing Is Required for Automatic Daylighting Controls in Secondary Sidelit Daylit Zones Complying with Section 140.6(d)

Issue Statement

NA7.6 does not explicitly state that acceptance testing is required for automatic daylighting controls in secondary sidelit daylit zones complying with the prescriptive requirements in §140.6(d).

Background

Industry (ATTCPs, ATTs, energy consultants, and so forth) has interpreted the Energy Code to mean that acceptance testing is required for automatic daylighting controls in secondary sidelit daylit zones complying with the prescriptive requirements in §140.6(d). This interpretation is consistent with the CEC's intent with respect to implementing the requirements. However, the NA7 procedures do not clearly support this interpretation. New language should be added to §130.4(a)3 and NA7.6 of the Energy Code to clarify the CEC's intent with respect to implementing the requirements.

Acceptance testing is required for lighting controls that are complying with certain mandatory requirements in §130.1. There are a few cases where the Energy Code and NA7 explicitly impose acceptance testing requirements for lighting controls complying with a prescriptive requirement — controls claiming the institutional tuning PAF or the daylight dimming plus off PAF.

Recommended Language Changes

Add language in NA7.6 to clarify that acceptance testing requirements apply to automatic daylighting controls in secondary sidelit daylit zones complying with §140.6(d). Staff's draft recommended language changes for NA7.6 are on page B-1 of Appendix B to this report.

Staff also recommends the language in §130.4(a)3 of the Energy Code be updated accordingly, as follows:

> Certifies that automatic daylight controls comply with Section 130.1(d) or Section 140.6(d) and Reference Nonresidential Appendix NA7.6.1;

Justification

Though there are various arguments to support the interpretation that acceptance testing is required for automatic daylighting controls in secondary sidelit daylit zones complying with §140.6(d), interpretations can be challenged if not based on clear requirements. To avoid potential confusion or accusations of underground regulations, it is essential that the regulations are clear on when acceptance testing is required for any automatic daylighting control, including those complying with prescriptive requirements. The need for clear regulations is particularly key when there are other explicit acceptance testing requirements for controls complying with a prescriptive requirement, as is the case with controls claiming the institutional tuning or daylight dimming plus off PAF.

Consequences of Not Making Changes

If the recommended changes are not made, the lack of explicit direction may lead to confusion or disagreements in interpretation. Builders or contractors may push back on whether they should be required to hire an ATT to test the automatic daylighting controls in secondary sidelit zones complying with §140.6(d). Similarly, AHJs may push back on requiring those controls to be tested to receive a certificate of occupancy. It is possible that none of these issues will arise, but there is a risk without explicit regulatory language.

Costs and Cost-Effectiveness

To staff's understanding, there should not be any additional costs associated with this clarification. Since the clarification is consistent with current and past practices, the changes should not impose any additional requirements on industry.

Potential Impacts

ATTCPs, ATTs, ATEs, the building industry, and AHJs should not be affected negatively by the recommended changes as they are consistent with current practice. The changes would improve existing procedural requirements and clarify the compliance and enforcement of the Energy Code requirements.

Further Information Needed

Staff would like to hear whether stakeholders have any input on staff's recommendations regarding the clarification of acceptance testing applicability to automatic daylighting controls complying with prescriptive requirements.

NA7.6.1 Cleanup Recommendations

Issue Statement

There are various minor issues with the grammar, punctuation, structure, consistency, and wording of the procedures in NA7.6.1.

Recommended Language Changes

Staff's draft recommended language changes to NA7.6.1 to address minor issues are on pages B-1 through B-6 of Appendix B.

Justification

These proposed minor changes would serve as clean-up to address minor issues with the grammar, punctuation, structure, consistency, and wording of the procedures in NA7.6.1.

Consequences of Not Making Changes

There would be no consequences if these recommended minor changes were not made, though the CEC would be missing an opportunity to make changes that would improve the quality of the procedures.

Costs and Cost-Effectiveness

There are no additional costs to parties involved in the ATTCP program, industry, AHJs, or the public associated with these recommended changes.

Potential Impacts

These recommended minor editorial changes would have no discernable effect on parties involved in the ATTCP program, industry, AHJs, or the public.

Further Information Needed

No further information is needed for these recommended minor clean-up changes, though staff welcomes feedback from stakeholders.

Demand Responsive Lighting Controls Acceptance Test

Align the Construction Inspection with the Energy Code and the Intended Purpose of Construction Inspections

Issue Statement

The NA7.6.3 procedures include steps that are not able to be verified through visual inspection before functional testing and a reference to requirements in the Energy Code without specific directions.

Background

The requirements in the acceptance testing procedures should be based on the criteria set forth in the Energy Code and should not introduce new requirements. The construction inspection should consist of targeted visual inspections and verification that the installation is complete in preparation for functional testing.

Given that demand-responsive control requirements were expanded for the 2019 Energy Code (including items that can be verified as part of the construction inspection) and the NA7.6.3.1 requirements were not updated accordingly, staff revised the 2019 demand-responsive lighting controls acceptance compliance document (NRCA-LTI-04-A) to include specific requirements from §110.12(a) that are appropriate for a construction inspection.

Recommended Language Changes

Staff recommends that the CEC replace the current construction inspection requirements with items from §110.12 that can be verified through visual inspections before functional testing. Staff's draft recommended language changes are on page B-9 of Appendix B.

Justification

The acceptance testing procedures in NA7 should be revised to be straightforward and directly incorporate the specific requirements found in the Energy Code. Replacing nonspecific phrases, such as "applicable requirements," will avoid the need for interpretations and guesswork by the AHJs. Staff has already revised the general construction inspection requirements on the 2019 NRCA-LTI-04-A by including procedures that are required by the Energy Code but not directly specified in NA7.6.1.1.

Moreover, the construction inspection procedures should reflect the current requirements in the Energy Code that can be verified by visual inspection before functional testing. Although the demand-responsive control requirements were expanded in §110.12 for the 2019 Energy Code, the NA7.6.3.1 procedures were not updated accordingly.

Consequences of Not Making Changes

There are no consequences if these changes are not made. The issue would be the continued ambiguity of compliance and enforcement with Energy Code requirements. Staff would need to continue to making interpretations of how to apply NA7.6.3.1 in the NRCA-LTI-04-A, the ATTs would continue to rely on the NRCA-LTI-04-A more than the vague NA7.6.3.1 procedures, and the NA7.6.3.1 procedures would continue to include steps that can be performed outside functional testing.

Costs and Cost-Effectiveness

The proposed changes would not create a new test or impose requirements that affect existing industry practices or cost-effectiveness analyses. These changes would improve existing procedural requirements and clarify the compliance and enforcement of the Energy Code requirements.

Potential Impacts

If the recommended changes are made, the CEC would need to update the NRCA-LTI-04-A to remove the items in the construction inspection based on NA7.6.3.1 requirements that are eliminated. The compliance document already has the suggested additions from staff applying the vague requirement to comply with the Energy Code, so no revisions would be necessary unless any other changes are made to §110.12 that could affect the construction inspection. (In this case, the NA7.6.3.1 requirements should be updated accordingly for the 2022 Energy Code.)

The ATTCPs would need to update certification training materials to reflect the revised construction inspection requirements and NRCA-LTI-04-A. The ATTCPs would also need to include the changes in recertification trainings, though existing ATTs and ATEs would already be familiar with the execution of the revised construction inspection from using the 2019 NRCA-LTI-04-A.

Further Information Needed

Staff would like to hear if stakeholders have any suggestions for how to improve the construction inspection requirements. The construction inspection requirements are meant to be limited to items that can be visually inspected before functional testing.

NA7.6.3 Cleanup Recommendations

Issue Statement

There are various minor issues with the grammar, punctuation, structure, consistency, and wording of the procedures in NA7.6.3.

Recommended Language Changes

Staff's draft recommended language changes to NA7.6.3 to address minor issues are on pages B-9 through B-12 of Appendix B.

Justification

These proposed changes would clean up minor issues with the grammar, punctuation, structure, consistency, and wording of the procedures in NA7.6.3.

Consequences of Not Making Changes

There would be no consequences if these recommended minor changes were not made, though the CEC would be missing an opportunity to make changes that would improve the quality of the procedures.

Costs and Cost-Effectiveness

There are no additional costs to parties involved in the ATTCP program, industry, AHJs, or the public associated with these recommended changes.

Potential Impacts

These recommended minor editorial changes would have no discernable effect on parties involved in the ATTCP program, industry, AHJs, or the public.

Further Information Needed

No further information is needed for these recommended minor clean-up changes, though staff welcomes feedback from stakeholders.

Institutional Tuning Power Adjustment Factor Acceptance Test

Move Procedures from NA7.7 to NA7.6

Issue Statement

The acceptance testing procedures for the institutional tuning PAF acceptance test are in the wrong section within NA7. The procedures are in the lighting controls installation section in NA7.7. However, the appropriate location is in NA7.6 for the lighting controls acceptance tests.

Recommended Language Changes

Staff recommends that the CEC move the institutional tuning PAF acceptance test procedures from the lighting controls installation requirements section (NA7.7) to the indoor lighting controls acceptance requirements section (NA7.6). The move would require the CEC to create a new subsection in the Reference Nonresidential Appendix (NA7.6.4) for the procedures. Staff's draft recommended language changes that reflect this move are on pages B-12 through B-14 of Appendix B.

Justification

NA7.6 is the appropriate section for the institutional tuning PAF acceptance test procedures because it is an indoor lighting control acceptance test. NA7.7 should only contain requirements for the installation of lighting controls, and not acceptance testing requirements.

Consequences of Not Making Changes

There would be no consequences if these recommended changes were not made, though the CEC would be missing an opportunity to make changes that would improve the quality of the procedures.

Costs and Cost-Effectiveness

There are no additional costs associated with these recommended changes.

Potential Impacts

These recommended changes would have no discernable effect on interested parties. The CEC would need to update the institutional tuning PAF acceptance compliance document (NRCA-LTI-05-A) to reflect the section numbering changes. While the NA7 and NRCA-LTI-05-A changes would need to be communicated to the ATTCPs, ATTs, and ATEs, the changes should not burden them.

Further Information Needed

No further information is needed.

Simplify the Requirements for Functional Testing During Institutional Tuning

Issue Statement

The functional testing procedures in the 2019 Energy Code state that if the ATT is observing the tuning of a system, the party responsible for the tuning must certify that the remainder of the system is tuned similarly. However, there is no mechanism for someone other than the ATT to certify results. The option to observe systems during testing and have another entity certify the results as correct is delegating ATT authority and is not an acceptable means of certification for institutional tuning systems.

Background

According to the input staff has already received from the ATTCPs, the two methods of observing or verifying tuning afterward are executed as a single test where the ATT checks to see if the system has been tuned and then proceeds. If it has not been tuned and the person responsible for tuning the system is not onsite to correct the issue, the ATT fails the test and returns after the systems have been set. Alternatively, if the person responsible for tuning the system is setting the system, the ATT can choose to work with that person to test the system or return after all systems are tuned.

There is no mechanism under the Energy Code for someone other than an ATT to certify tuning results.

Recommended Language Changes

Staff recommends that the CEC eliminate the existing requirements for ATTs to observe the first seven systems being tuned and the party responsible for tuning to certify the rest of the systems were tuned accordingly. Without these requirements, the ATTs would have the option to conduct acceptance testing during the tuning or after systems have been tuned, and sampling would be permissible for buildings with more than seven areas claiming the PAF. The differences are that the ATTs could use a combination of the testing methods (instead of either/or) and there would not be a requirement for the ATT's duties to be delegated. Staff's draft recommended language changes are on page B-13 of Appendix B.

Justification

The acceptance testing procedures in NA7 should be implementable and consistent with the intent of the Energy Code. Staff has heard directly from the ATTCPs that the current procedures are not practical to implement or even possible, considering the CEC has not provided a place for this on the NRCA-LTI-05-A or any other compliance document. The proposed recommendations would allow the procedures to be consistent with the intent of the Energy Code and the acceptance test, as well as ensure the procedures are implementable.

Consequences of Not Making Changes

The current acceptance test procedures in NA7.7.5.2.3 do not provide options for compliance with the Energy Code requirements that are completely implementable. As a result, the lighting controls ATTCPs, ATTs, and ATEs are hampered by an inadequate acceptance test procedure and compliance documentation. Changes to the functional testing requirements are necessary to address this deficiency, and support compliance and enforcement efforts.

Costs and Cost-Effectiveness

The recommended changes will reflect and support current acceptance testing and enforcement practices. There will be no additional costs associated with the recommended changes. There may be cost reductions in terms of clarifying the compliance options that may lead to a minor streamlining of inspection approvals and potential improvement of construction timelines.

Potential Impacts

If the recommended changes are made, the NRCA-LTI-05-A would need minor revisions since it never provided the mechanism for the person responsible for tuning to certify the systems not observed by the ATT. The NA7 and NRCA-LTI-05-A changes would need to be reflected in the ATTCPs' trainings and communicated to ATTs and ATEs. This effect would be minimal though since the changes reflect current practice.

Further Information Needed

Staff would like to get stakeholder input on the following questions:

- Do the ATTCPs, ATTs, and ATEs agree with staff's recommendation?
- Are there additional recommendations related to the methods of testing systems claiming the institutional tuning PAF?

NA7.7.5.2/NA7.6.4 Cleanup Recommendations

Issue Statement

There are various minor issues with the grammar, punctuation, structure, consistency, and wording of the procedures in NA7.7.5.2. (Note: per staff's recommendation in the section titled "Move Procedures from NA7.7 to NA7.6" of this report, the language discussed in this section would be NA7.6.4 instead of NA7.7.5.2.)

Recommended Language Changes

Staff's draft recommended language changes to NA7.7.5.2 to address minor issues are on pages B-12 through B-14 of Appendix B.

Justification

These proposed minor changes would clean up minor issues with the grammar, punctuation, structure, consistency, and wording of the procedures in NA7.7.5.2.

Consequences of Not Making Changes

There would be no consequences if these recommended minor changes were not made, though the CEC would be missing an opportunity to make changes that would improve the quality of the procedures.

Costs and Cost-Effectiveness

There are no additional costs to parties involved in the ATTCP program, industry, AHJs, or the public associated with these recommended changes.

Potential Impacts

These recommended minor changes would have no discernable effect on parties involved in the ATTCP program, industry, AHJs, or the public.

Further Information Needed

No further information is needed for these recommended minor cleanup changes. However, staff welcomes feedback from stakeholders, including any additional cleanup that stakeholders have identified.

Outdoor Lighting Controls Acceptance Tests

Consolidate the Motion Sensor Procedures into One Acceptance Test

Issue Statement

Procedures for the testing of motion sensors exist in more than one place in the Energy Code. There is an acceptance test for motion sensors alone, as well as an automatic scheduling controls acceptance test that includes sections for automatic scheduling controls alone and for automatic scheduling controls installed in conjunction with motion sensors. The motion sensor-related content is generally the same, with a few procedures contained only in the motion sensor-only test.

Background

For the 2019 Energy Code, the CEC changed the outdoor lighting controls requirements in §130.2(c) so that automatic scheduling controls would always be required, and motion sensors are required only in specific applications. Therefore, motion sensors will not be installed without automatic scheduling controls. The CEC also revised the outdoor lighting controls acceptance testing procedures to direct ATTs to follow specific procedures in NA7.8 for automatic scheduling controls and motion sensors used in conjunction, yet the existing motion sensor-only procedures were not revised or removed.

To provide a compliance document that can be used and understood by the ATTs completing it and the AHJs enforcing its use, CEC staff removed the motion sensor-only section from the 2019 outdoor lighting control acceptance compliance document (NRCA-LTO-02-A). Any requirements from the motion sensor-only procedures that are not covered by the procedures to test motion sensors and automatic scheduling controls in conjunction were carried over to the joint section of the 2019 NRCA-LTO-02-A, including the motion sensor sampling protocols.

Recommended Language Changes

Staff recommends that the CEC eliminate the redundancy in the existing acceptance tests in NA7.8. This elimination will be accomplished by combining the motion sensor acceptance testing procedures into one test by consolidating the motion sensor-related procedures from the automatic scheduling controls acceptance test (currently NA7.8.7 and NA7.8.8) with the motion sensor-only acceptance test (currently NA7.8.1 and NA7.8.2). In addition, staff recommends expanding the requirements to include any motion sensor requirements from NA7.8.7 and NA7.8.8 that were not already covered by NA7.8.1 and NA7.8.2. The resulting acceptance test procedures will include an automatic scheduling controls test and a motion

sensor test. The motion sensor test will require that the automatic scheduling controls test be conducted first. Staff's draft recommended language changes are on pages B-14 through B-17 of Appendix B.

Justification

It is confusing to have a test for motion sensors alone and have an automatic scheduling controls test with procedures for just automatic scheduling controls and automatic scheduling controls installed in conjunction with motion sensors. Automatic scheduling controls are always required, but motion sensors are not. The current procedures for testing both controls installed in conjunction are compartmentalized, so it seems unnecessary to have procedures to test both together. However, if the procedures for both installed in conjunction will remain, the motion sensor-only acceptance test should be eliminated.

Consequences of Not Making Changes

If the recommended changes are not made, NA7.8 will continue to contain procedures that are confusing, redundant, and hard to implement. As a result, the lighting controls ATTCPs, ATTs, and ATEs are hampered by an inadequate acceptance test procedure and compliance documentation. Changes to the organization of the procedures are necessary to address this deficiency and support compliance and enforcement efforts.

Costs and Cost-Effectiveness

There should be no additional costs associated with the recommended changes since no new tests would be created, or requirements imposed. There may be cost reductions in terms of clarifying the compliance options that may lead to a minor streamlining of inspection approvals and potential improvement of construction timelines.

Potential Impacts

If the recommended changes are made, the NRCA-LTO-02-A will require revision to include a motion sensor-only section and remove the motion sensor plus automatic scheduling control section. The NA7 and NRCA-LTO-02-A changes would need to be reflected in the ATTCPs' training materials and communicated to ATTs and ATEs. These changes would be a significant (though not necessarily negative) impact since the ATTs and ATEs would already have been familiar with the alternate approach for the 2019 Energy Code.

Further Information Needed

There is another way to consolidate the various motion sensor procedures apart from staff's recommendations. The alternate approach would be what staff did when updating the 2019 NRCA-LTO-02-A: eliminate the motion sensor-only procedures and carry over any missing requirements to the motion sensor plus automatic scheduling control procedures. Although the revised compliance document has not been used when this report was written, staff believes this alternate approach creates unnecessary complications in documenting test results. However, staff would like to work with all interested parties to determine if staff's recommendations need further consideration.

Staff would like to get stakeholder input on the following:

1. Is it necessary to test motion sensor functionality with automatic scheduling controls, or would it be appropriate to test motion sensors and automatic scheduling controls separately?
2. Is sampling of motion sensors necessary? Are there enough motion sensors to trigger the need for sampling?
3. Do you agree with staff's assessment that having multiple motion sensor procedures is a problem?
4. Do you agree with staff's recommended approach and concerns about the alternate approach?
5. Do you have any additional suggestions or comments about what the issue is and how it could be resolved?

Consolidate Astronomical Time Switch Control Sections

Issue Statement

The astronomical time switch control acceptance test is redundant to the automatic scheduling controls acceptance test.

Background

Astronomical time switch controls are a type of automatic scheduling controls. Despite this, NA7.8 contains an acceptance test for automatic time switch controls and automatic scheduling controls. The procedures for both tests are identical, except for the control name. Upon discovering this oversight, staff revised the 2019 NRCA-LTO-02-A by removing a separate section for astronomical time switch controls since the removal would not affect compliance.

Recommended Language Changes

Consolidate the astronomical time switch control (currently NA7.8.5 and NA7.8.6) and automatic scheduling control (currently NA7.8.7 and NA7.8.8) sections from NA7. Staff's draft recommended language changes are on pages B-16 and B-17 of Appendix B.

Justification

There is no benefit to having a section specifically for astronomical time switch controls as the procedures are identical to the automatic scheduling controls procedures.

Consequences of Not Making Changes

If the recommended changes are not made, NA7.8 would continue to contain procedures that are unnecessary. These unnecessary procedures may lead to confusion for industry and enforcement personnel looking to the NA7.8 procedures. It could also mean double work in future code cycles to update both sections for the same changes.

Costs and Cost-Effectiveness

There should be no additional costs associated with the recommended changes. There may be cost reductions in terms of clarifying the compliance options that may lead to a minor streamlining of inspection approvals and potential improvement of construction timelines.

Potential Impacts

If the recommended changes are made, no revisions to the NRCA-LTO-02-A would be necessary because staff already eliminated the astronomical time switch control section from the 2019 version of the compliance document. Minor updates would be necessary to the ATTCPs' training materials, but the effect would be inconsequential because the changes are aligned with 2019 NRCA-LTO-02-A.

Further Information Needed

Staff would like to get stakeholder input on the following questions:

1. Do you agree with staff's proposal to eliminate the astronomical time switch control acceptance test?
2. Should the CEC keep the sections and revise them to be specific to astronomical time switch controls? If so, how should the procedures be revised?

Restructure NA7.8 and Other Cleanup Recommendations

Issue Statement

There are various minor issues with the grammar, punctuation, structure, and consistency of the procedures throughout NA7.8.

Recommended Language Changes

Staff's draft recommended language changes to NA7.8 to address minor issues are on pages B-14 through B-17 of Appendix B.

Justification

These proposed minor changes would clean up minor issues with the grammar, punctuation, structure, consistency, and wording of the procedures in NA7.8.

Consequences of Not Making Changes

There would be no consequences if these recommended minor changes were not made, though the CEC would be missing an opportunity to make changes that would improve the quality of the procedures.

Costs and Cost-Effectiveness

There are no additional costs to parties involved in the ATTCP program, industry, AHJs, or the public associated with these recommended changes.

Potential Impacts

These recommended minor editorial changes would have no discernable effect on industry or AHJs. The ATTCPs' training materials would need updating for any references to section numbers that changed, but this updating would be inconsequential.

Further Information Needed

No further information is needed for these recommended minor cleanup changes. However, staff welcomes feedback from stakeholders, including any additional cleanup that stakeholders have identified.

Minor Editorial Recommendations for NA7

Issue Statement

There are terms used throughout the NA7 procedures that are not spelled according to the spelling in §100.1(b) of the Energy Code or consistently within NA7.

Recommended Language Changes

To be consistent with the spelling in §100.1(b), the following terms should be adjusted throughout the NA7 procedures:

- "Time-switch control" should be "time switch control."
- "Occupancy sensor/sensing control" should be "occupant sensor/sensing control."
- "Photocontrol" should be "photo control."
- "Shutoff control" and "shut off control" should be "shut-off control."

Justification

The terms should be spelled consistently throughout all documents.

Consequences of Not Making Changes

There would be no consequences if these recommended minor changes were not made, though the CEC would be missing an opportunity to make changes that would improve the quality of the procedures.

Costs and Cost Effectiveness

There are no additional costs associated with these recommended changes.

Potential Impacts

These recommended minor editorial changes would have no discernable impact on interested parties.

Further Information Needed

No further information is needed for these recommended minor editorial changes.

APPENDIX A:
Glossary

Term	Definition
ATTCP Acceptance test technician certification provider	An agency, organization, or entity approved by the CEC to train, certify, and oversee acceptance test technicians and acceptance test employers relating to either lighting controls or mechanical systems. ATTCPs are authorized to certify only those technicians and employers for which they are approved. ATTCPs approved to certify technicians and employers relating to lighting controls acceptance testing are sometimes referred to as "lighting controls ATTCPs," and ATTCPs approved to certify technicians and employers relating to mechanical systems acceptance testing are sometimes referred to as "mechanical ATTCPs."
ATT Acceptance test technician	A field technician who is certified by an authorized acceptance test technician certification provider to perform acceptance testing of either lighting controls or mechanical systems. ATTs are authorized to perform only those acceptance tests for which they are certified. ATTs certified to perform lighting controls acceptance testing are sometimes referred to as "lighting controls ATTs," and ATTs certified to perform mechanical systems acceptance testing are sometimes referred to as "mechanical ATTs."
LC-ATT Lighting controls acceptance test technician	A field technician who is certified by an authorized lighting controls acceptance test technician certification provider to perform lighting controls acceptance testing.
M-ATT Mechanical acceptance test technician	A field technician who is certified by an authorized mechanical acceptance test technician certification provider to perform mechanical acceptance testing.

Term	Definition
ATE Acceptance test employer	A person or entity who employs an acceptance test technician and is certified by an authorized acceptance test technician certification provider. ATEs are authorized to employ only those technicians for which they are certified. ATEs certified to employ technicians that perform lighting controls acceptance testing are sometimes referred to as "lighting controls ATEs," and ATEs certified to employ technicians that perform mechanical systems acceptance testing are sometimes referred to as "mechanical ATEs."
CEC California Energy Commission	The California State Energy Resources Conservation and Development Commission.
Energy Code Building Energy Efficiency Standards	The regulations contained in Title 24, Part 6 and Title 24, Part 1, Chapter 10 of the California Code of Regulations.
HERS Home Energy Rating System	The California Home Energy Rating System as described in Title 20, Chapter 4, Article 8, Section 1670.
NRCA Nonresidential Certificate of Acceptance	A compliance document used to record the results of an acceptance test that must be completed on certain controls and equipment before the installation is deemed to comply with the Energy Code.
Reference Appendices	The support documentation for the Building Energy Efficiency Standards. The document consists of three sections: Reference Joint Appendices, Reference Residential Appendices, and Reference Nonresidential Appendices.

Term	Definition
Reference Appendices Joint Appendix (JA)	A series of appendices used to convey the requirements for compliance of Title 24, Part 6 of the Energy Code pertaining to both residential and nonresidential construction: JA1 – Glossary JA2 – Reference Weather/Climate Data JA3 – Time Dependent Valuation (TDV) JA4 – U-factor, C-factor, and Thermal Mass Data JA5 – Technical Specifications for Occupant Controlled Smart Thermostats JA6 – HVAC System Fault Detection and Diagnostic Technology JA7 – Data Registry Requirements JA8 – Qualification Requirements for High Efficacy Light Sources JA9 – Qualification Requirements for Low Leakage Air-Handling Units JA10 – Test Method for Measuring Flicker of Lighting Systems JA11 – Qualification Requirements for Photovoltaic System JA12 – Qualification Requirements for Battery Storage System JA13 – Water Pump Water Heater Demand Management Systems
Reference Appendices Nonresidential Appendix (NA)	A series of appendices used to convey the requirements for compliance of Title 24, Part 6 of the Energy Code pertaining to nonresidential construction: NA1 – Nonresidential HERS Verification, Testing, and Documentation Procedures NA2 – Nonresidential Field Verification and Diagnostic Test Procedures NA3 – Fan Motor Efficiencies NA4 – Compliance Procedures for Relocatable Public-School Buildings NA5 – RESERVED NA6 – Alternate Default Fenestration Procedure to Calculate Thermal Performance NA7 – Installation and Acceptance Requirements for Nonresidential Buildings and Covered Processes NA8 –Luminaire Power

Term	Definition
PAF Power adjustment factor	An adjustment to the lighting requirements in Table 140.6-A or a performance compliance option (using the performance method). Certain design features and technologies have the capacity to increase the daylighting potential of spaces. Some of these design features and technologies may be used in conjunction with automatic daylighting controls to receive PAFs.
XML Extensible Markup Language	A set of rules for encoding documents in machine readable form to facilitate the electronic transmission of documents. XML standard was developed by the W3C.
XML Schema	Refers to XML Schema Definition Language, commonly referred to as XSD, which is another standard defined by the W3C. An XML schema uses XSD to define a set of rules to which an XML document must conform in order to be considered valid according to that schema. The rules can include definitions of major organizational units, definitions of data elements and attributes data types, constraints on valid values such as upper and lower bounds, and whether data is required or optional.

APPENDIX B:
Draft Proposed NA7 Language

NA7.6 Indoor Lighting Controls Acceptance Requirements

Lighting control acceptance testing shall be performed on:

(a) Automatic ~~D~~daylighting ~~C~~controls complying with Section 130.1(d) or Section 140.6(d).

(b) Shut-off ~~C~~controls complying with Section 130.1(c).

(c) Demand ~~R~~responsive ~~C~~controls complying~~in accordance~~ with Section 110.12~~130.1(e)~~.

(d) Lighting controls installed to earn a power adjustment factor for institutional tuning in accordance with Section 140.6(a)2J.

NA7.6.1 Automatic Daylighting Controls Acceptance Tests

NA 7.6.1.1 Construction Inspection

(a) The general lighting in skylit and primary sidelit daylit zones, or the general lighting in the combined primary and secondary sidelit daylit zones in parking garages, is controlled by automatic daylighting controls.~~Verify that automatic daylighting controls qualify as one of the required control types, are installed, and fully functional in accordance with each applicable requirement in Section 130.1(d), and list each specific exception claimed, from Section 130.1(d).~~

(b) The daylit zones are shown on the plans.

(c) The automatic daylighting controls provide separate control for luminaires in each type of daylit zone. Luminaires that fall in both a skylit and primary sidelit daylit zone are controlled as part of the skylit zone.

(d) For photosensors located within a daylit zone, at least one photosensor is not readily accessible to unauthorized personnel, including inside a locked case or under a cover that requires a tool for access.

NA 7.6.1.2 Functional ~~t~~Testing

All photo controls serving more than 5,000 ft² of daylit area shall undergo functional testing. Photo controls that are serving smaller spaces may be sampled as follows:

For buildings with up to five (5) photo controls, all photo controls shall be tested. For buildings with more than five (5) photo controls, sampling may be done on spaces with similar sensors and cardinal orientations of glazing; sampling shall include a minimum of one (1) photo control for each group of up to five (5) additional photo controls. If the first photo control in the sample group passes the functional test, the remaining building spaces in the sample group

also pass. If the first photo control in the sample group fails the functional test, the rest of the photo controls in the group shall be tested. If any tested photo control fails the functional test, it shall be repaired, replaced or adjusted until it passes the test.

For each photo control to be tested, ~~do the following: (a) T~~test each group of lights controlled separately by the photo control according to the ~~following~~ protocol in NA 7.6.1.2.1 or NA 7.6.1.2.2. In all interior spaces other than parking garages, ~~a separate test shall be~~ conducted ~~a~~ separate test for daylighting control of the primary sidelit daylit zone ~~separate~~ from the secondary sidelit daylit zone.

NA 7.6.1.2.1 Continuous Dimming Control Systems

This requirement is for systems that have more than 10 levels of controlled light output in a given zone.

(a) Identify the minimum daylighting location in the controlled zone (~~R~~reference ~~L~~location). This can be identified using either the illuminance method or the distance method and will be used for illuminance measurements in subsequent tests. For parking garages, the reference location should always be the farthest edge of the secondary sidelit daylit zone away from the glazing or opening.

Illuminance Method

~~(b)~~ Turn ~~OFF~~off the controlled lighting and measure daylight illuminance within zones illuminated by controlled luminaires. ~~(c) Identify the R~~The reference ~~L~~location~~; this~~ is the task location with lowest daylight illuminance in the zone illuminated by controlled luminaires. ~~This location will be used for illuminance measurements in subsequent tests.~~Turn the controlled lighting back on before proceeding to the no daylight test.

Distance Method

The reference is~~Identify~~ the task location within the zone illuminated by controlled luminaires that is farthest away from daylight sources. ~~This is the Reference Location and will be used for illuminance measurements in subsequent tests.~~

~~(d)~~(b) No daylight test. Simulate or provide conditions without daylight. Verify and document the following:

1. Document the reference illuminance at the reference location, which is the electric lighting illuminance level at the reference location identified in NA 7.6.1.2.1(a).

~~1~~2. The ~~A~~automatic daylight control system turns on all controlled lighting to~~provides appropriate control so that electric lighting system is providing~~ full designed light output level unless ~~otherwise specified by design documents~~it is documented that multilevel luminaires have been tuned to less than full output. If lighting has been tuned, the automatic daylight control system turns on all controlled lighting to the tuned light output level.

~~2. Document the reference illuminance, which is the electric lighting illuminance level at the reference location identified in Step 1.~~

3. Light output is stable with no discernable flicker.

~~(e)~~(c) Full daylight test. Simulate or provide bright conditions where the daylight illuminance is greater than 150 percent of the reference illuminance measured during the no daylight test. Verify and document the following:

1. For areas other than parking garages, the ~~L~~lighting power reduction is at least 65 percent under fully dimmed conditions. For parking garages, the controlled lighting power consumption is zero. ~~and l~~

~~1.~~2. Light output is stable with no discernable flicker.

~~2.~~3. Only luminaires in daylit zones are affected by daylight control. ~~.~~ If the daylighting controls control lighting outside of the daylight zones, including those behind permanent obstructions as described in Section 100.1(b)~~130.1(d)1~~, the control system is not compliant.

~~3.~~4. If a ~~P~~power ~~A~~adjustment ~~F~~factor (PAF) is claimed for ~~D~~daylight ~~D~~dimming plus off~~OFF~~ controls in accordance with Section 140.6(a)2H, compliant systems shall automatically turn off~~OFF~~ the luminaires that are receiving this credit. This portion of the full daylight test does not apply to lighting systems that are not claiming a PAF~~Power Adjustment Factor~~ for ~~D~~daylight ~~D~~dimming plus off~~OFF~~ controls.

~~(f)~~(d) Partial daylight test. Simulate or provide daylight conditions where the illuminance ~~(fc) from~~ provided only by daylight ~~only~~ at the ~~R~~reference ~~L~~location is between 60 and 95 percent of the ~~R~~reference ~~I~~illuminance ~~(fc) documented in Step 2~~measured during the no daylight test. Verify and document the following:

1. Measure that the combined ~~illuminance of~~ daylight and controlled electric lighting illuminance ~~(fc)~~ at the reference location is no less than the ~~electric lighting~~reference illuminance ~~(fc) at this location~~measured during the no daylight test ~~documented in Step (d)2~~.

2. Measure that the combined ~~illuminance of~~ daylight and controlled electric lighting illuminance ~~(fc)~~ at the ~~R~~reference ~~L~~location is no greater than 150 percent of the reference illuminance ~~(fc) documented in Step (d)2~~measured during the no daylight test.

3. Light output is stable with no discernable flicker.

4. Only luminaires in daylit zones are affected by daylight control.

NA 7.6.1.2.2 Stepped Switching or Stepped Dimming Control Systems

This requirement is for systems that have no more than 10 discrete steps of control of light output.

~~If the control has 3 steps of control or less, conduct the following tests for all steps of control. If the control has more than 3 steps of control, testing 3 steps of control is sufficient for showing compliance.~~

(a) Identify the minimum daylighting location~~(s)~~ in the controlled zone~~.~~ (~~R~~reference ~~L~~location). This can be identified using either the illuminance method or the distance method and will be used in subsequent tests. For parking garages, the reference location should always be the farthest edge of the secondary sidelit daylit zones away from the glazing or opening.

Illuminance Method

~~1.~~ Turn ~~OFF~~off the controlled lighting and measure daylight illuminances within a zone illuminated by controlled luminaires. ~~2. Identify t~~The reference location~~; this~~ is the task location with lowest daylight illuminance in the zone illuminated by controlled luminaires. ~~This location will be used for illuminance measurements in subsequent tests. 3.~~ Turn the controlled lighting~~s~~ back on before proceeding to the no daylight test~~ON~~.

Distance Method

~~1. Identify~~The reference location is the task location within the zone illuminated by controlled luminaires that is farthest away from daylight sources. ~~This is the reference location and will be used for illuminance measurements in subsequent tests.~~

(b) No daylight test. Simulate or provide conditions without daylight ~~for a stepped switching or stepped dimming control system~~. Verify and document the following:

1. Document the reference illuminance, which is the electric lighting illuminance level measured at the reference location identified in NA 7.6.1.2.2(a).

~~1~~2. If the control is manually adjusted (not self-commissioning), make note of the time delay and override time delay or set time delay to minimum setting. This condition shall be in effect through ~~step 4~~NA 7.6.1.2.2(b)4.

~~2~~3. The ~~A~~automatic daylight control system turns ~~ON~~on all ~~stages of~~ controlled lighting~~s~~ to full design light output level unless it is documented that multilevel luminaires have been ~~"~~tuned~~"~~ to less than full output ~~and providing design illuminance (fc) levels~~. If lighting has been tuned, the automatic daylight control system turns on all controlled lighting to the tuned light output levels.

~~3~~4. ~~S~~tepped dimming control system provides reduced flicker over the entire operating ~~range as specified by §110.9.~~Light output is stable with no discernable flicker.

~~4. Document the reference illuminance which is the electric lighting illuminance level measured at the reference location identified in Step 1.~~

(c) Full daylight test. Simulate or provide bright conditions. Verify and document the following:

1. For areas other than parking garages, Llighting power reduction of controlled luminaires is at least 65 percent. For parking garages, the controlled lighting power consumption is zero.

2. Light output is stable with no discernable flicker.

3. The stepped dimming control system provides reduced flicker as specified by Section 110.9(b)3B. The stepped switching control system provides for stable light output with no discernable flicker.

2.4. Only luminaires in daylit zones (toplit zone, primary sidelit zone and secondary sidelit zone) are affected by daylight control. If the daylighting controls control lighting outside of the daylight zones, including those behind permanent obstructions as described in Section 100.1(b)130.1(d)1, the control system is not compliant.

5. If a PAF is claimed for daylight dimming plus off controls in accordance with Section 140.6(a)2H, compliant systems shall automatically turn off the luminaires that are receiving this credit. This portion of the full daylight test does not apply to lighting systems that are not claiming a PAF for daylight dimming plus off controls.

(d) Partial daylight test. For each control stage that is tested in this step, the control stages with lower setpoints than the stages tested are left ON and those stages of control with higher setpoints are dimmed or controlled off.Simulate or provide daylight conditions where the illuminance provided only by daylight at the reference location is between 60 and 95 percent of the reference illuminance to test the system's control steps between on and off so that each control stage turns on and off or dims.

If the control system has one (1) to three (3) steps of control between on and off, test all control steps between on and off. If the control system has more than three (3) steps between on and off, testing three (3) control steps between on and off is sufficient to demonstrate compliance. If the control system has zero (0) steps between on and off, the partial daylight test is not necessary. For stepped switching control systems, steps in a controlled zone are achieved by turning some luminaires or groups of luminaires on or off without any steps between on and off.

Verify and document the following for each control stagestep tested:

1. Measure that the combinedDocument the total daylight and electric lighting illuminance level measured at itsthe reference location just after the stage of control step is executed dims or shuts off a stage of lighting: isA.The total measured illumination shall be no less than the reference illuminance measured at this location during the no daylight test documented in Step 2.

2.B. Measure that the combined daylight and electric lighting illuminance at the reference location just after the control step is executed isThe total measured illumination shall be no greater than 150 percent of the reference illuminance measured during the no daylight test.

3. Light output is stable with no discernable flicker.

~~2.~~4. The stepped switching control system~~stage shall~~ does not cycle luminaires~~stages of lighting~~ on and off, or the stepped dimming control system does not cycle luminaires between dimming levels ~~and undimmed~~ while daylight illuminance remains constant.

~~3.~~5. Only luminaires in daylit zones ~~(toplit zone, primary sidelit zone, and secondary sidelit zone)~~ are affected by daylight control.

(e) Verify time delay.

1. Verify that time delay automatically resets to normal mode within 60 minutes.

2. Set normal mode time delay to at least three minutes.

3. Confirm that there is a time delay of at least three (3) minutes between the time when illuminance exceeds the setpoint for a given control step~~dimming stage~~ and when the control system dims or switches off the controlled lightings.

NA7.6.2 Shut-off Controls Acceptance Tests

~~*NA7.6.2.1 General Requirements*~~

~~Verify that the shut-off control qualifies as one of the required control types, is installed, and is fully functional in accordance with each applicable requirement in Section 130.1(c), or that the application meets one of the exceptions. List each specific exemption claimed, from Section 130.1(c).~~

NA 7.6.2.1 Occupant Sensing Lighting Controls

~~*NA7.6.2.2*~~*NA7.6.2.1.1* ~~*Occupancy Sensing Lighting Control*~~ *Construction Inspection*

Prior to ~~F~~functional testing, verify and document the following:

(a) Occupancy sensor has been located to minimize false signals.~~;~~

(b) Occupancy sensor is located ~~N~~no closer than four (4) feet from any HVAC diffuser.

(c) Passive infrared sensor pattern does not enter into adjacent zones.

(d) Occupancy sensors do not encounter any obstructions that could adversely affect desired performance.

(e) Ultrasonic occupancy sensors do not emit audible sound.

~~*NA7.6.2.3*~~*NA7.6.2.1.2* ~~*Occupancy Sensing Lighting Control*~~ *Functional ~~t~~Testing*

For buildings with up to seven (7) occupancy sensors, all occupancy sensors shall be tested. For buildings with more than seven (7) occupancy sensors, sampling may be done on spaces with similar sensors and space geometries.~~;~~ ~~s~~Sampling shall include a minimum of one (1) occupancy sensor for each group of up to seven (7) additional occupancy sensors. If the first occupancy sensor in the sample group passes the acceptance test, the remaining building

spaces in the sample group also pass. If the first occupancy sensor in the sample group fails the acceptance test, the rest of the occupancy sensors in that group must be tested. If any tested occupancy sensor fails it shall be repaired, replaced or adjusted until it passes the test.

For each sensor to be tested do the following:

(a) Unoccupied test. ~~For a representative sample of building spaces, s~~Simulate an unoccupied condition in the controlled space. Verify and document the following:

1. The occupancy sensor turns the controlled lighting off or partially off~~Lights controlled by occupancy sensors turn off~~ within a maximum of 20 minutes from the start of an unoccupied condition.

   a. In the partially off state, partial-off occupancy sensors automatically reduce lighting power by at least 50 percent, or meet one of the following exceptions:

      i. For metal halide or high-pressure sodium lighting in warehouses, automatically reduce lighting power by at least 40 percent.

      ii. In aisle ways and open areas in warehouses in which the installed lighting power is 80 percent or less of the value allowed under the Area Category Method, automatically reduce lighting power by at least 40 percent.

      iii. In corridors and stairways in which the installed lighting power is 80 percent or less of the value allowed under the Area Category Method, automatically reduce lighting power by at least 40 percent.

   b. Occupancy sensors in parking garages, parking areas, and loading and unloading areas have at least one control step between 20 to 50 percent of the design lighting power.

      i. If the occupancy sensor serves metal halide luminaires with a lamp plus ballast mean system efficacy of 75 lumens per watt in parking garages, parking areas, and loading and unloading areas, the control has at least one control step between 20 to 60 percent of the design lighting power.

2. The occupant sensing control does not trigger a false ~~"~~on~~"~~ from movement in an area adjacent to the space containing the controlled luminaires or from HVAC operation.

3. Signal sensitivity is adequate to achieve desired control.

(b) Occupied test. ~~For a representative sample of building spaces, s~~Simulate an occupied condition in the controlled space. Verify and document the following:

1. Status indicator or annunciator operates correctly.

2. ~~Lights controlled by occupancy sensors turn on immediately upon an occupied condition, OR sensor indicates space is "occupied" and lights are turned on manually (automatic OFF and manual ON control strategy).~~Immediately upon an occupied condition:

a. The occupancy sensor or partial-off occupancy sensor turns on controlled lighting; *OR*

b. The vacancy sensor indicates a space is occupied and the controlled lighting may be turned on manually; *OR*

c. The first stage of a partial-on occupancy sensor automatically activates between 50 to 70 percent of the lighting. After the first stage occurs, manual switches allow an occupant to activate the alternate set of lights, activate 100 percent of the lighting power, and manually deactivate all of the lighting.

NA7.6.2.2 Automatic Time Switch Lighting Controls

~~NA7.6.2.4~~NA7.6.2.2.1 ~~Automatic Time Switch Lighting Control~~ Construction Inspection

Prior to ~~F~~functional testing, verify and document the following:

(a) Automatic time switch control is programmed with acceptable weekday, weekend, and holiday (if applicable) schedules.

(b) Document for the owner automatic time switch programming including weekday, weekend, holiday schedules as well as all set-up and preference program settings.

(c) ~~Verify t~~The correct time and date are~~is~~ properly set in the time switch.

(d) ~~Verify t~~The battery back-up (if applicable) is installed and energized.

~~(e) Override time limit is set to no more than 2 hours.~~

~~(f)~~(e) Manual ~~O~~override switches remote from area with controlled luminaires have annunciator lights.

~~NA7.6.2.5~~NA7.6.2.2.2 ~~Automatic Time Switch Lighting Control~~ Functional ~~t~~Testing

(a) Occupied test. Simulate an occupied condition in the controlled space. Verify and document the following:

1. The automatic time switch control is able to turn the controlled lighting on and off.~~All lights can be turned on and off by their respective area control switch.~~

2. ~~Verify t~~The automatic time switch control only operates lighting in the enclosed space (ceiling-height partitioned area) in which ~~the switch~~it is located.

~~3. For the area controlled by an automatic time switch control with a time override located in and for the area, verify the lighting can be turned on manually by initializing the time override and the lighting is configured to remain ON for no more than 2 hours.~~

~~4~~3. For testing purposes, ~~the area controlled by an~~if the automatic time switch control ~~with~~has an automatic holiday shut-off~~OFF~~ feature that turns off all controlled lighting for at least 24 hours and then resumes the normally scheduled operation, verify that the

controlled lighting ~~in the area~~ can be turned off automatically by initiating the holiday shut-off~~OFF~~ feature.

~~5~~4. ~~For the area controlled by an~~If the automatic time~~-~~ switch control ~~with~~has manual-on~~ON~~ mode configured, ~~verify~~ the controlled lighting ~~in the area~~ can be turned ~~ON~~on manually ~~when it is manually activated~~.

(b) Unoccupied test. Simulate an unoccupied condition in the controlled space. Verify and document the following:

1. All non-exempt lighting turns off in accordance with the programmed time switch schedules.

2. The automatic time switch control includes a manual override that meets the following requirements:

a. It is readily accessible.

b. It is located in the controlled space.

c. It allows the lighting to remain on for no more than two (2) hours once the manual override is initiated.

~~2. Manual override switch allows only the lighting in the enclosed space (ceiling height partitioned) where the override switch is located to turn on or remain on until the next schedule shut off occurs.~~

NA7.6.3 Demand Responsive Controls Acceptance Tests

NA7.6.3.1 Construction Inspection

Prior to ~~F~~functional testing, verify and document the following:

(a) The demand responsive control is capable of communicating in a valid communication protocol (Wi-Fi, ZigBee, BACnet, Ethernet or hard wiring). Prior to functional testing, the demand responsive controls shall be setup to communicate in a valid communication protocol for the functional testing in the following section, NA7.6.3.2.

~~(a) That the demand responsive control is capable of receiving a demand response signal directly or indirectly through another device and that it complies with the requirements in Section 130.1(e).~~

~~(b) If the demand response signal is received from another device (such as an EMCS), that system must itself be capable of receiving a demand response signal from a utility meter or other external source.~~

NA7.6.3.2 Functional ~~t~~Testing

For building with up to seven (7) enclosed spaces requiring demand responsive lighting controls, all spaces shall be tested. For buildings with more than seven (7) enclosed spaces

requiring demand responsive lighting controls, sampling may be done on additional spaces with similar lighting systems; sampling shall include a minimum of one (1) enclosed space for each group of up to seven (7) additional enclosed spaces. If the first enclosed space with a demand responsive lighting control in the sample group passes the acceptance test, then the remaining building spaces in the sample group also pass. If the first enclosed space with a demand responsive lighting control in the sample group fails the acceptance test, then the rest of the enclosed spaces in that group must be tested. If any tested demand responsive lighting control system fails, then it shall be repaired, replaced or adjusted until it passes the test.

Test the reduction in lighting power due to the demand responsive lighting control using one of the following two methods in NA7.6.3.2.1 or NA7.6.3.2.2. The lighting power reduction for the building should be at 15 percent when the lighting systems are at full output and no more than 50 percent when the lighting systems are at minimum output. These settings are just for testing purposes and may need to be set prior to functional testing.

NA7.6.3.2.1 Method 1: Illuminance Measurement.

Measure the reduction in illuminance in enclosed spaces required to meet Section 130.1(b), as follows:

(a) In each space, select one location for illuminance measurement. The chosen location must not be in a skylit or primary sidelit area. When placed at the location, the illuminance meter must not have a direct view of a window or skylight. If this is not possible, perform the test at a time and location at which daylight illuminance provides less than half of the design illuminance. Mark each location to ensure that the illuminance meter can be accurately located.

(b) Full output test

1. Using the manual switches/dimmers in each space, set the lighting system to full output. Note that the lighting in areas with photo controls or occupancy/vacancy sensors may be at less than full output or may be off.

2. Take one illuminance measurement at each location, using an illuminance meter.

3. Simulate a demand response condition using the demand responsive control.

4. Take one illuminance measurement at each location with the electric lighting system in the demand response condition.

5. Calculate the area-weighted average reduction in illuminance in the demand response condition, compared with the full output condition. The area-weighted average reduction must be at least 15% percent but must not reduce the combined illuminance from electric light and daylight to less than 50% percent of the design illuminance in any individual space.

(c) Minimum output test

1. Using the manual switches/dimmers in each space, set the lighting system to minimum output (but not off). Note that the lighting in areas with photo controls or occupancy/vacancy sensors may be at more than minimum output or may be off.

2. Take one illuminance measurement at each location, using an illuminance meter.

3. Simulate a demand response condition using the demand responsive control.

4. Take one illuminance measurement at each location with the electric lighting system in the demand response condition.

5. In each space, the illuminance in the demand response condition must not be less than the illuminance in the minimum output condition or 50~~%~~ percent of the design illuminance, whichever is less.

   EXCEPTION: In daylit spaces, the illuminance in the demand response condition may reduce below the minimum output condition, but in the demand response condition the combined illuminance from daylight and electric light must be at least 50~~%~~ percent of the design illuminance.

NA7.6.3.2.2 Method 2: Current ~~m~~Measurement~~:~~

~~-~~Measure the reduction in electrical current in spaces required to meet Section 130.1(b), as follows:

(a) At the lighting circuit panel, select at least one lighting circuit that serves spaces required to meet Section ~~130.1(e)~~110.12.

(b) Full output test

1. Using the manual switches/dimmers in each space, set the lighting system to full output. Note that the lighting in areas with photo controls or occupancy/vacancy sensors may be at less than full output or may be off.

2. Take one electric current measurement for each selected circuit.

3. Simulate a demand response condition using the demand responsive control.

4. Take one illuminance measurement at each location with the electric lighting system in the demand response condition.

5. Add together all the circuit currents and calculate the reduction in current in the demand response condition, compared with the full output condition. The combined reduction must be at least 15~~%~~ percent but must not reduce the output of any individual circuit by more than 50~~%~~percent.

(c) Minimum output test

1. Using the manual switches/dimmers in each space, set the lighting system to minimum output (but not off). Note that the lighting in areas with photo controls or occupancy/vacancy sensors may be at more than minimum output or may be off.

2. Take one electric current measurement for each selected circuit.

3. Simulate a demand response condition using the demand responsive control.

4. Take one electric current measurement for each selected circuit with the electric lighting system in the demand response condition.

5. In each space, the electric current in the demand response condition must not be less than 50% percent of the electric current value at full output or the electric current in the minimum output condition, whichever is less.

   EXCEPTION: Circuits that supply power to the daylit portion of enclosed spaces as long as lighting in non-daylit portions of the enclosed space in the demand response condition is not reduced below the lesser of 50 percent power input level or the current in the minimum light output condition.

NA7.6.4 Institutional Tuning Power Adjustment Factor Acceptance Tests~~*NA7.7.5.2 Acceptance Test for Institutional Tuning*~~

~~For buildings with up to seven (7) enclosed areas claiming the Institutional Tuning PAF (power adjustment factor), all areas shall be tested. For buildings with more than seven (7) areas claiming this PAF, random sampling may be done on seven of the larger enclosed areas with tuned dimming systems. If any of the areas in the sample group of seven areas fails the acceptance test, another group of seven areas must be tested. If any tested system fails, it shall be tuned until it passes the test.~~

NA7.6.4.1~~*NA7.7.5.2.1 Construction Inspection of Institutional Tuning*~~

Prior to ~~F~~functional testing, verify and document the following:

(a) The controls or the methods of controlling the maximum output of luminaires is such that the maximum light output of the controlled lighting system can be limited and that normal operation of the controlled lighting does not override the maximum light output.

(b) The controls are not readily accessible to unauthorized personnel.

(c) The construction documents specify which lighting systems shall have their maximum light output or maximum power draw set to no greater than 85 percent of full light output or full power draw.

NA7.6.4.2~~*NA7.7.5.2.3 Functional Testing of Institutional Tuning*~~

For buildings with up to seven (7) enclosed areas claiming the institutional tuning power adjustment factor (PAF), all areas shall be tested. For buildings with more than seven (7) areas claiming this PAF, random sampling may be done on seven (7) of the larger enclosed areas with tuned dimming systems. If any of the areas in the sample group of seven (7) areas

fails the acceptance test, another group of seven (7) areas must be tested. If any tested system fails, it shall be tuned until it passes the test.

For each area to be tested, follow the procedures in NA7.6.4.2.1 or NA7.6.4.2.2.~~do the following:~~

~~(a) The acceptance test technician shall either observe the first seven (7) systems being successfully tuned or shall verify systems that have already been tuned using the sampling protocol described in NA7.7.6.2.~~

~~(b) If the acceptance test technician is observing the tuning of the system, the party responsible for the tuning shall certify that the remainder of the systems are tuned in a similar manner.~~

NA7.6.4.2.1 Method 1: Observation of ~~the s~~Systems ~~d~~During ~~i~~Institutional ~~t~~Tuning

~~Step 1:~~(a) Determination of maximum power or light output prior to ~~I~~institutional ~~T~~tuning

~~(a)~~1. Set all lighting controls to provide maximum output of the tested system without applying the limits specified for institutional tuning.

~~(b)~~2. Measure the full light output at a location where the illuminance is due to the controlled lighting or measure the power draw of the controlled lighting. Current measurements may be used instead of power measurements.

~~Step 2:~~(b) Institutional ~~T~~tuning and ~~P~~post-tuning ~~M~~measurement

~~(a)~~1. Apply the limits specified for institutional tuning to the lighting system. Do not alter any other control settings.

~~(b)~~2. Verify the light or power reduction after institutional tuning by measuring the light output at the same location as in ~~Step 1~~NA7.6.4.2.1(a) or measuring the power draw of the same circuit as in ~~Step 1~~NA7.6.4.2.1(a). Current measurements may be used instead of power measurements.

~~(c)~~3. If the light output or power draw measured in ~~Step 2(b)~~NA7.6.4.2.1(b)2 is 85~~%~~ percent or less of the light output or power draw measured in ~~Step 1(b)~~NA7.6.4.2.1(a)2, the system passes this test; otherwise the system fails this test.

NA7.6.4.2.2 Method 2: Verification of ~~s~~Systems ~~a~~Already ~~t~~Tuned

~~Step 1:~~(a) Measurement of tuned lighting system

~~(a)~~1. Set all lighting controls except ~~I~~institutional ~~T~~tuning controls to provide maximum output of tested system. Controls set to maximum light output include but not limited to~~:~~ manual dimmers, multilevel occupancy sensing, and automatic daylighting controls.

~~(b)~~2. Measure full light output at location where most of the illuminance is due to the controlled lighting or measure power draw of the controlled lighting. Current measurements may be used instead of power measurements.

~~Step 2:~~(b) Measurement of lighting system with ~~I~~institutional ~~T~~tuning overridden

~~(a)~~1. Reset institutional tuning controls to allow full light output. Set all lighting controls to provide maximum output of tested system including but not limited to institutional tuning controls, manual dimmers, multilevel occupant sensing, and automatic daylighting controls.

~~(b)~~2. Measure full light output at the same location as in ~~Step 1~~NA7.6.4.2.2(a) or measure the power draw of the same circuit as in ~~Step 1~~NA7.6.4.2.2(a). Current measurements may be used instead of power measurements.

~~(c)~~3. If the light output or power draw measured in ~~Step 1(b)~~NA7.6.4.2.2(a)2 is 85~~%~~ percent or less of the light output or power draw measured in ~~Step 2(b)~~NA7.6.4.2.2(b)2, the system passes this test; otherwise the system fails this test.

~~Step 3:~~(c) Restore ~~I~~institutional ~~T~~tuning settings

~~(a)~~1. If tested system passed the test in ~~Step 2~~NA7.6.4.2.2(b), restore ~~I~~institutional ~~T~~tuning settings.

NA7.8 Outdoor Lighting Controls Acceptance Requirements~~Test~~

~~Verify that outdoor lighting controls qualify as one of the required control types, are installed, and are fully functional in accordance with each applicable requirement in Section 130.2(c), or that the application meets one of the exceptions. List each specific exception claimed, from Section 130.2(c).~~

Lighting control acceptance testing shall be performed on:

(a) Photo controls complying with Section 130.2(c)1.

(b) Automatic scheduling controls complying with Section 130.2(c)2.

(c) Motion sensing controls complying with Section 130.2(c)3.

NA7.8.1 Motion Sensor Acceptance Test

~~NA7.8.1 Motion Sensor~~NA7.8.1.1 Construction Inspection

Prior to ~~F~~functional testing, verify and document the following:

(a) Sensor ~~has been~~is located to minimize false signals.

(b) Sensor~~s~~ is not triggered by motion outside of ~~adjacent~~controlled area.

(c) Desired sensor coverage is not blocked by obstructions that could adversely affect performance.

~~NA7.8.2 Motion Sensor~~NA7.8.1.2 Functional ~~t~~Testing

For buildings with up to seven (7) ~~outdoor~~motion sensors, all ~~outdoor~~motion sensors shall be tested. For buildings with more than seven (7) ~~outdoor~~motion sensors for outdoor lighting system, sampling may be done on outdoor areas with similar sensors that cover similar unobstructed areas; sampling shall include a minimum of one (1) ~~outdoor~~motion sensor for each group of up to seven (7) additional ~~outdoor~~motion sensors. If the first sensor in the sample group passes the acceptance test, the remaining outdoor areas in the sample group also pass. If the first sensor in the sample group fails the acceptance test, the rest of the sensors in that group shall be tested and any failed sensor in the sample group shall be repaired or replaced and retested until the sensor passes the test.

~~Step 1:~~(a) Simulate motion in area under ~~lights~~luminaire controlled by the motion sensor. Verify and document the following:

~~(a)~~i. Status indicator operates correctly.

~~(b)~~ii. ~~Lights~~Luminaires controlled by sensor~~s~~ turn on immediately upon entry into the area lit by the controlled ~~lights~~luminaires near the sensor.

~~(c)~~iii. Signal sensitivity is adequate to achieve desired control.

~~Step 2:~~(b) Simulate no motion in area with lighting controlled by the sensor. Verify and document the following:

~~(a)~~i. ~~Lights~~The lighting power for each controlled outdoor luminaire~~by the sensor reduces light output~~ is reduced by at least 50 percent within a maximum of ~~30~~15 minutes from the start of an unoccupied condition.

~~(b)~~ii. The sensor does not trigger a false "on" from movement outside of the controlled area.

~~(c)~~iii. Signal sensitivity is adequate to achieve desired control.

NA7.8.~~1~~2 Photo Control Acceptance Test

~~NA7.8.3 Photocontrol~~NA7.8.2.1 Construction Inspection

Prior to functional testing, ~~V~~verify and document the following:

(a) The photo control is installed.

~~NA7.8.4 Photocontrol~~NA7.8.2.2 Functional Testing

Verify and document the following:

(a) During daytime simulation, all controlled outdoor luminaires ~~lights~~ are turned off.

(b) During nighttime simulation, all controlled outdoor luminaires ~~lights~~ are turned on.

~~NA7.8.5 Astronomical Time-Switch Control Construction Inspection~~

~~Prior to Functional Testing, confirm and document the following:~~

~~(a) Verify the astronomical time-switch control is installed.~~

~~(b) Verify the astronomical time switch control is programmed with ON schedule and OFF schedule that matches the schedules in the construction documents. If the schedule is unknown, verify that the programmed schedule matches the default schedule where the OFF schedule is from midnight to 6am and the ON schedule is all other nighttime hours, seven days per week.~~

~~(c) Demonstrate and document for the lighting control programming including ON schedule and OFF schedule, for weekday, weekend, and holidays (if applicable).~~

~~(d) Verify the correct time and date is properly set in the control.~~

~~*NA7.8.6 Astronomical Time-Switch Control Functional Testing*~~

~~Verify and document the following:~~

~~(a) During daytime simulation, all controlled outdoor lighting is turned OFF.~~

~~(b) During nighttime simulation, all controlled outdoor lighting is turned ON in accordance with the astronomical schedule.~~

~~(c) During nighttime simulation, power of controlled outdoor lights is turned OFF or reduced by at least 50 percent in accordance with the programmed schedule.~~

NA7.8.3 Automatic Scheduling Control Acceptance Test

Astronomical time switch controls are a type of automatic scheduling control and shall be tested using the procedures in this section.

~~*NA7.8.7*~~*NA7.8.3.1* ~~*Automatic Scheduling Control*~~ *Construction Inspection*

Prior to ~~F~~ffunctional ~~T~~ttesting, verify and document the following:

(a) ~~Verify t~~The automatic scheduling control is installed.

(b) ~~Verify t~~The control is programmed with ~~ON schedules and OFF schedule~~on and off schedules that match~~es~~ the schedules in the construction documents. If the schedule is unknown, verify that the programmed schedule matches the default schedule where the ~~OFF~~off schedule is from midnight to 6am and the ~~ON~~on schedule is all other nighttime hours, seven days per week.

~~(c) Demonstrate and document for the lighting control programming including both ON schedule and OFF schedule, for weekday, weekend, and holidays (if applicable).~~

~~(d)~~(c) ~~Verify t~~The correct time and date are~~is~~ properly set in the control.

~~Prior to Functional Testing for occupancy-based control type, verify and document the following:~~

~~(a) Sensor has been located to minimize false signals.~~

~~(b) Sensors is not triggered by motion outside of adjacent area.~~

~~(c) Desired sensor coverage is not blocked by obstructions that could adversely affect performance.~~

~~*NA7.8.8*~~*NA7.8.3.2* ~~*Automatic Scheduling Control*~~ *Functional Testing*

Verify and document the following:

(a) During daytime simulation, all controlled outdoor luminaires ~~lighting is~~ are turned OFF.

(b) During nighttime simulation, all controlled outdoor luminaires ~~lighting is~~ are turned ON in accordance with the programmed schedule.

(c) During nighttime simulation, outdoor lighting power ~~of controlled lighting~~ is ~~turned OFF or~~ reduced by at least 50 percent and no more than 90 percent and all controlled outdoor luminaires are turned OFF during scheduled unoccupied periods in accordance with the programmed schedule.

~~For automatic schedule control used in conjunction with motion sensing control, verify and document the following:~~

~~(a) During daytime simulation, all controlled outdoor lighting is turned off.~~

~~(b) Simulate motion in area under the luminaire controlled by the motion sensing control. Verify and document the following:~~

~~i. Status indicator operates correctly.~~

~~ii. Luminaires controlled by the sensor turn on immediately upon entry into the area lit be the controlled luminaires near the motion sensing control.~~

~~iii. Signal sensitivity is adequate to achieve desired control.~~

~~(c) During simulation of normally occupied schedule, simulate no occupancy in area with lighting controlled by the motion sensing control. Verify and document the following:~~

~~i. The outdoor lighting power controlled by the motion sensing control is reduced by at least 50 percent within a maximum of 15 minutes from the start of an unoccupied condition. Fraction of light output reduction is an acceptable proxy for reduction in lighting power.~~

~~ii. Signal sensitivity is adequate to achieve desired control.~~

~~(d) During simulation of normally occupied schedule, simulate no occupancy in area with lighting controlled by the motion sensing control. Verify and document the following:~~

i. The outdoor lighting power controlled by the motion sensing control is reduced by at least 50 percent within a maximum of 15 minutes from the start of an unoccupied condition. Fraction of light output reduction is an acceptable proxy for reduction in lighting power.

ii. Signal sensitivity is adequate to achieve desired control.