



# 2013 Nonresidential Energy Standards Overview

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## Goals of this Course

- Identify/clarify the major changes in the 2013 Energy Standards for nonresidential newly constructed buildings, additions, and alterations (*in sequential order of §*)
- Simplify compliance and enforcement for the 2013 changes during:
  - The plan review process (Plans Examiners)
    - ✓ Identify what to look for on the compliance forms and building plans
  - The field inspection process (Field Inspectors)
    - ✓ Identify which building components and forms to verify



# QUESTIONS...

- **Question sessions**
  - 30 minutes before lunch
  - 30 minutes before end
    - Raise hand to ask question
- **All other questions**
  - Type into Q and A box at anytime
    - List of Q and A from webinar will be posted online



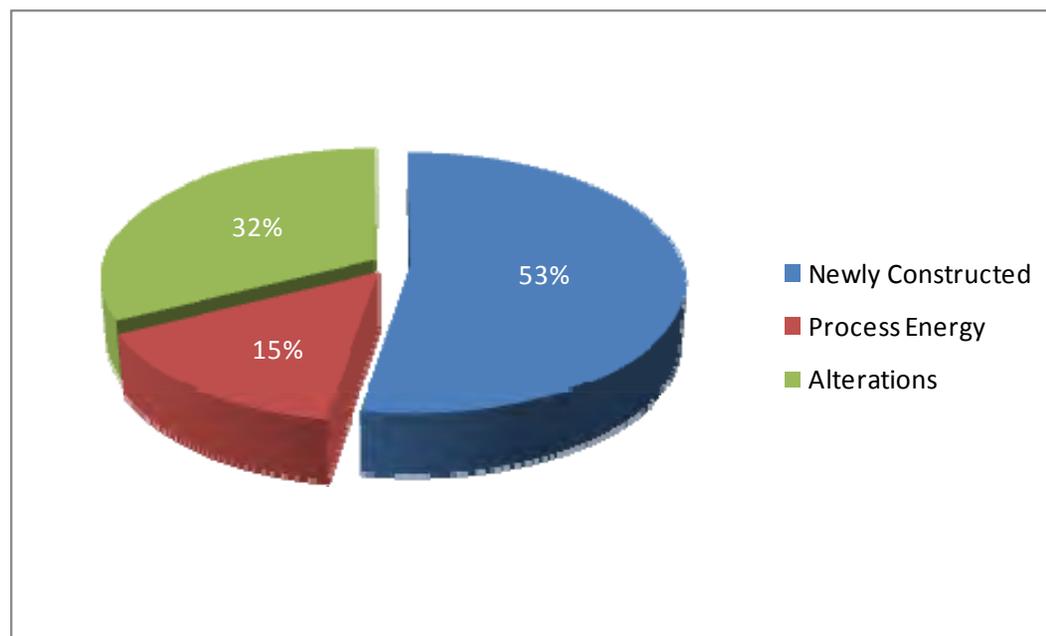


*Let's discuss the 2013  
Building Energy Efficiency  
Standards*



# 2013 Nonresidential Energy Savings

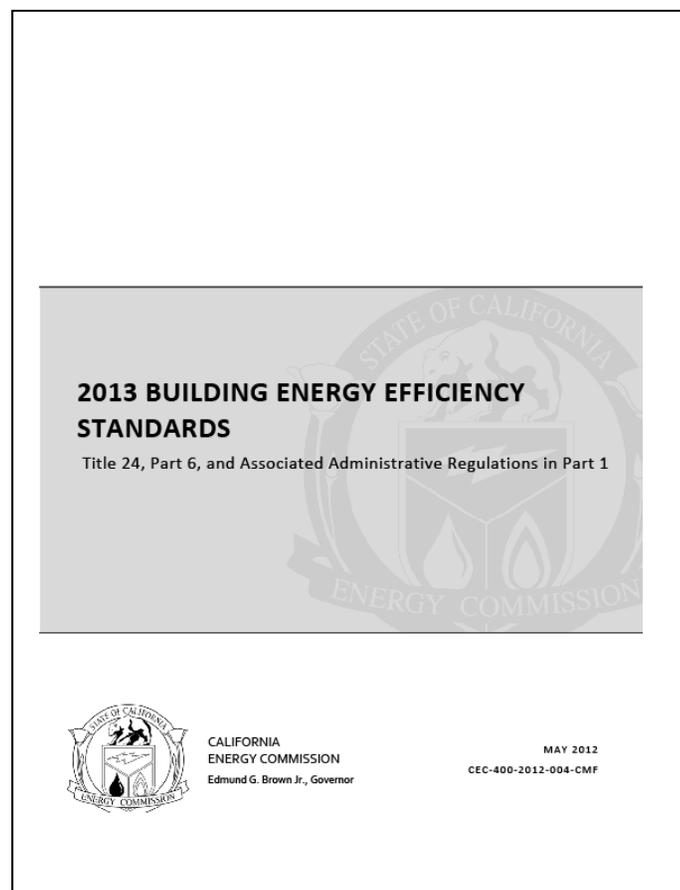
- **Overall, 30% “better” than 2008 Standards**
- **2013 Nonres. Standards will save:**
  - 372 GWH/yr
  - 6.7 Mtherms/yr
  - 84 MW (first year)





# 2013 Building Energy Efficiency Standards

- **Effective on July 1, 2014**
  - Building permit applications submitted on or after this date
- **Larger projects in plan review may be affected:**
  - Need to resubmit if permits pulled on/after effective date





# 2013 Documents

- Building Energy Efficiency Standards
- Nonresidential Compliance Manual
- Reference Appendices
- All docs. available online at:

[www.energy.ca.gov/title24](http://www.energy.ca.gov/title24)





# Summary of Major Changes

- **Section #s** (see [cheat sheet handout](#))
- **Forms nomenclature**
  - MECH-1C → NRCC-MCH-01
  - LTG-2A → NRCA-LTI-02-A
- **Building Commissioning**
- **Solar Zone ready reqs.**
- **Covered Processes**
- **Field Technician Certification**
  - Acceptance Testing
- **Compliance Form Registration**
  - Effective 1/1/2015

\* See summary of changes [handout](#)

# 2013 Energy Standards Section # Cheat Sheet

2008 Section #	2013 Section #
100	100.0
101	100.1
102	100.2
110	110.0
111	110.1
112	110.2
113	110.3
114	110.4
115	110.5
116	110.6
117	110.7
118	110.8
119	110.9
-	<b>110.10</b>
120	120.0
121	120.1
122	120.2
123	120.3
124	120.4
125	120.5
126	120.6
-	<b>120.7</b>
-	<b>120.8</b>
-	<b>120.9</b>
130	130.0
131	130.1
132	130.2
133	130.3
134	130.4
-	<b>130.5</b>
140	140.0
141	140.1
142	140.2
143	140.3
144	140.4
145	140.5
146	140.6
147	140.7
148	140.8
-	<b>140.9</b>
149	141.0
-	<b>141.1</b>
150	150.0
151	150.1
152	150.2

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## 1.5 What's New for 2013

The process to develop the 2013 Standards began with a call for ideas in winter of 2010, moved through a series of IOU Sponsored stakeholder meetings throughout the state, Energy Commission staff workshops and Energy Commission hearings in 2011 through 2012 and concluded at the adoption hearing on May 23, 2012. Energy Commission staff, contractors, utilities and many others participated in the process. The following paragraphs summarize the principle changes that resulted.

### 1.5.1 All Buildings

*Revisions* to the administrative §10-103 sets the format and informational order for electronic compliance document registration and submittal and for electronic retention of compliance documentation, including the nonresidential forms, for future use and clarifies the roles and responsibilities of the documentation author and the responsible person;

1. §10-109 describes the rules for approving compliance software, alternative component packages, exceptional methods, data registries and related data input software, or electronic document repositories.
2. §10-111 describes the rules for reporting fenestration U-factor, SHGC, and VT.
3. §110.3(c)5 explains the requirements for the water heating recirculation loops serving multiple dwelling units, high-rise residential, hotel/motel, and nonresidential occupancies..
4. Revisions to §110.9 now covers ballasts and luminaires and residential vacancy sensors.

### 1.5.2 Nonresidential Buildings

#### **Envelope**

1. Increased low-slope cool roof requirements (increase reflectance from 0.55 to 0.63 for new construction and alterations). (§140.3(a)1Aia1).
2. Established a maximum air leakage rate (0.04 cfm/sf) except in mild climate zones. (§140.3(a)9B).
3. Increased fenestration requirements to reduce solar gains and increase visual transmittance for daylighting; 0.36 U-factor, 0.25 SHGC, VT 0.42 for fixed windows; the numbers are different for operable windows and skylights. (§140.3(a)5B,C & D).
4. *Fenestration. The Standards now include Dynamic Glazing, Window Films and new maximum values for Visible Transmittance (VT). New Dynamic Glazing, Window Films requirements and changes are in the Reference Nonresidential Appendix NA6 and NA7.4.*
5. Added mandatory Roof insulation requirements and minimum insulation for demising walls. (§110.8(e) & (f)).

## **Lighting**

1. Clarification and simplification of existing language; removing exceptions no longer relevant. (§130.0-130.5, 140.6-140.8).
2. Lighting control devices moving from Title 24 Part 6 to Title 20; Lighting control systems shall now be acceptance tested for Title 24. (§110.9(b) & §130.4(a)).
3. Nonresidential indoor lighting, advanced multi-level lighting controls (controllable ballasts) increased in granularity (in addition to ON/OFF, increasing from one intermediate level to three intermediate levels for or continuous dimming), favoring dimmable ballasts for linear fluorescent lighting systems. These controls will allow precise and non-interruptive adjustment of lighting to match the available daylighting, and provide dimming and demand response function throughout the building. (§130.1(a) 2C) & §130.1(b).
4. Enhancing, modifying, and adding to the prescriptive and mandatory daylighting control requirements; daylighting language significantly simplified. (§130.1(d) & (§140.6(d)).
5. Requirements for demand responsive reduction of lighting power being applied to smaller spaces. (§130.1(e)).
6. Mandatory Automated Lighting Controls and Switching Requirements in Warehouses and Libraries - Require the installation of occupancy sensors in warehouse aisle ways and open spaces, and library stack aisles. (§130.1(c)6A & B).
7. Mandatory automated lighting controls and switching requirements for hotels and multifamily building corridors - Require the installation of occupancy sensors in corridors and stairwells in lodging and multifamily buildings. (§130.1(c)6C).
8. New mandatory occupancy sensor and daylighting controls in parking garage spaces. (§130.1(d)3).
9. Increased requirements for multi-level lighting controls for nonresidential outdoor lighting. (§130.2(c)3B).
10. Alternate path to comply with existing outdoor lighting cutoff (shielding) requirements, phasing in the new Backlight, Uplight, Glare (BUG) requirements. (§130.2(b)).
11. Reduction of allowed lighting power density for some nonresidential indoor and outdoor lighting applications. (§140.6(c) and §140.7(d))
12. Tailored lighting revisions - Reduce the allowed LPD for Floor Display, Wall Display, and Ornamental Lighting under the Tailored Compliance. §140.6(c)3I, J & K).
13. Plug Load Circuit Controls - requiring automatic shut-off controls of electric circuits that serve plug loads, including task lightings, in office buildings. (§130.5(d)1).
14. Hotel/Motel Guest Room Occupancy Controls for HVAC and lighting systems - would require installation of occupancy controls for HVAC equipment, and

all lighting fixtures in hotel/motel guest rooms, including plug-in lighting. (§120.2(e)4 & §130.1(c)8).

15. Reduction of threshold when lighting alterations must comply with the Standards, from when 50% of the luminaires are replaced, to when 10% of the luminaires are replaced. Consistent with proposed changes to ASHRAE 90.1-2010. (§141.0(b)2I & J).

### **Mechanical**

1. Added requirements for Fan Control and Integrated Economizers. Packaged units down to 6 tons must be VAV with the ability to modulate cooling capacity to 20% of maximum. Economizers must also be able to modulate cooling capacity to match VAV units. (§140.4(c) & (e))
2. Reduced ability for HVAC systems to reheat conditioned air. (§140.4(d))
3. Increased chiller efficiency requirements, consistent with ASHRAE 90.1-2010. (§140.4(i))
4. Increased cooling tower energy efficiency and WATER Savings. (§140.4(k)2)
5. Added requirements for commercial boiler combustion controls. (§140.4(k)3)
6. Added acceptance tests for HVAC sensors and controls, including those for demand controlled ventilation. (§120.5(a))
7. Added efficiency requirements for small motors. (§140.4(c)4)
8. Added credit for evaporative systems that meet the Western Cooling Efficiency Challenge (WCEC program to acknowledge high energy and water efficiency in evaporative systems).
9. Moving Fault Detection and Diagnostics (FDD) protocols for air temperature, economizers, damper modulation, and excess outdoor air to mandatory measures from the current compliance option. (§120.2(i))

### **Electrical**

1. Added mandatory requirement for receptacle controls in private offices, open office areas, reception lobbies, conference rooms, kitchens, and copy rooms to automatically shut off task lighting and other plug loads when the area is not occupied. (§130.5(d)).
2. Added mandatory requirement for electrical panels to be isolated by energy end use (e.g. lighting, HVAC, plug loads). (§130.5(b)2).

### **Covered Processes**

The 2013 Standards now cover some specific process energy applications, such as supermarket refrigeration, refrigerated warehouses, commercial kitchen ventilation requirements, laboratory exhaust, parking garage ventilation, compressed air, and computer rooms. Definitions for Covered Processes and Exempt Processes were added. Covered Processes are defined as processes for which there are listed requirements. All other processes are Exempt Processes. Specific requirements for Covered Processes are in separate sections (§120.6 Mandatory and §140.9 Prescriptive). It should be noted that the HVAC equipment efficiencies in §110.1 and §110.2 also apply to Covered Processes. In the 2013 Standards, the Covered Processes include:

1. Increased mandatory requirements for refrigerated warehouses (§120.6(a))
2. Added mandatory requirements for commercial supermarket refrigeration (§120.6(b)).
3. Added mandatory ventilation control requirements for parking garages (§120.6(c)).
4. Added mandatory requirements for process boilers (§120.6(d))
5. Added mandatory requirements for storage and unloading for compressed air systems (§120.6(e)). Added prescriptive requirements for HVAC systems serving computer rooms (§140.9(a)).
6. Added prescriptive ventilation control requirements for commercial kitchens (§140.9(b)).
7. Added prescriptive requirements for variable air volume for laboratory exhaust systems. (§140.9(c)).

### **Solar Ready**

1. Added mandatory requirements for nonresidential buildings (3 stories or less) to make provisions to more easily enable the future addition of solar electric or solar water heating systems. (§110.10(a)4).

### **Commissioning**

1. Moved Part 11 commissioning requirements to Part 6 for energy-related building components. (§120.8).
2. Added mandatory requirements for design-phase commissioning, which includes an early review of design intent documents and highlighting efficiency specifications in both construction documents and Standards compliance forms. (§120.8(d)).

### **Compliance Option**

Hybrid Evaporative Cooling Systems in Nonresidential Buildings



*Let's talk about the changes  
to the Administrative  
Regulations  
§10-103*



# Signatures, Registration, Technician Certification

## 2008 – §10-103(a)1, 3, 4, 5

- Designer/Builder and Doc. Author signatures req. on Certificate of Compliance (-1C forms)
- Contractor/Installer signature req. of Certificate of Installation (-INST)
- Field Technician and Contractor signatures req. on Certificate of Acceptance (-A forms)
- HERS Rater signature req. on Certificate of Field verification and diagnostic testing (HERS)

## 2013 – §10-103(a)1, 3, 4, 5

- Doc. Author signature on Certificate of:
  - Installation (NRCI)
  - Acceptance (NRCA)
  - Field verification and diagnostic testing (NRCV)
- Registration req. for ALL forms effective 1/1/15
  - Contingent upon approval of nonres. data registry



## Signatures, Registration, Technician Certification *cont.*

- **New Acceptance Test Technician Certification Provider (ATTCP) reqs. in §10-103-A and §10-103-B**
- **Field Technician must be trained and certified by ATTCP to conduct acceptance testing**
  - Employer (contractor) training also req.
  - Applicable to Mechanical Acceptance Testing
  - Applicable to Lighting Acceptance Testing
- **Effective when thresholds in Standards are met**
- **Info. available at:** [http://www.energy.ca.gov/title24/2013standards/provider\\_cert/](http://www.energy.ca.gov/title24/2013standards/provider_cert/)

Such verification shall include determination that:

- A. All installed features, materials, components or manufactured devices, regulated by the Appliance Efficiency Regulations or Part 6 are indicated, when applicable, on the Certificate(s) of Installation, Certificate(s) of Acceptance and Certificate(s) of Verification, and are consistent with such features, materials, components or manufactured devices given in the plans and specifications and the Certificate(s) of Compliance approved by the local enforcement agency.
- B. All required Certificates of Installation are posted, or made available with the building permit(s) issued for the building, and are made available to the enforcement agency for all applicable inspections, and that all required Certificates of Installation conform to the specifications of Section 10-103(a)3.
- C. All required Certificates of Acceptance are posted, or made available with the building permit(s) issued for the building, and are made available to the enforcement agency for all applicable inspections, and that all required Certificates of Acceptance conform to the specifications of Section 10-103(a)4.
- D. All required Certificates of Verification are posted, or made available with the building permit(s) issued for the building, and are made available to the enforcement agency for all applicable inspections, and that all required Certificates of Verification conform to the specifications of Section 10-103(a)5.

**EXCEPTION to Section 10-103(d):** For newly constructed buildings that meet the requirements of the New Solar Homes Partnership (NSHP) as specified in the NSHP Guidebook, the enforcement agency may waive the plan check and inspection of all measures other than the mandatory measures in the building.

**NOTE:** Authority cited: Section 25402, Public Resources Code. Reference: Section 25402, Public Resources Code.

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## SECTION 10-103-A – NONRESIDENTIAL LIGHTING CONTROLS ACCEPTANCE TEST TRAINING AND CERTIFICATION

- (a) **Scope.** The requirements of this section apply to nonresidential lighting control Acceptance Test Technicians and Employers, and the Certification Providers that train and certify them.
- (b) **Industry Certification Threshold.** Lighting Controls Acceptance Test Technician and Employer certification requirements shall take effect when the Energy Commission finds that each of the following conditions are met. Until such time that 10-103-A(b)1 and 10-103-A(b)2 are met, Field Technicians are allowed to complete the acceptance test requirements in Section 130.4 without completing the Acceptance Test Technician certification requirements.
  - 1. **Number of Certified Acceptance Test Technicians.** There shall be no less than 300 Lighting Controls Acceptance Test Technicians certified to perform the acceptance tests in Building Energy Efficiency Standards, Section 130.4. The number of certified Acceptance Test Technicians shall be demonstrated by Certification Provider-prepared reports submitted to the Energy Commission.
  - 2. **Industry Coverage by Certification Provider(s).** The Certification Provider(s) approved by the Energy Commission, in their entirety, shall provide reasonable access to certification for technicians representing the majority of the following industry groups: electrical contractors, certified general electricians, professional engineers, controls installation and start-up contractors and certified commissioning professionals who have verifiable training, experience and expertise in lighting controls and electrical systems. The Energy Commission will determine whether in their entirety reasonable access to certification is provided by considering factors such as certification costs commensurate with the complexity of the training being provided, certification marketing materials, prequalification criteria, class availability, and curriculum.
- (c) **Qualifications and Approval of Certification Providers.** The Acceptance Test Technician Certification Providers (ATTCPs) shall submit a written application to the Energy Commission with a summary and the related background documents to explain how the following criteria and procedures have been met:
  - 1. **Requirements for Applicant ATTCPs to Document Organizational Structure.** ATTCPs shall provide written explanations of the organization type, by-laws, and ownership structure. ATTCPs shall explain in writing how their certification program meets the qualification requirements of Title 24, Part 1, Section 10-

(g) **Review by the Energy Commission.**

If the Energy Commission determines there is a violation of these regulations or that an Acceptance Test Technician Certification Provider is no longer providing adequate certification services, the Energy Commission may revoke the authorization of the Acceptance Test Technician Certification Provider pursuant to Section 1230 et. seq. of Title 20 of the California Code of Regulations.

**NOTE:** Authority cited: Sections 25402, 25402.1, 25213, Public Resources Code. Reference: Sections 25007, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8 and 25910, Public Resources Code.

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## **SECTION 10-103-B – NONRESIDENTIAL MECHANICAL ACCEPTANCE TEST TRAINING AND CERTIFICATION**

- (a) **Scope.** The requirements of this section apply to nonresidential mechanical Acceptance Test Technicians and Employers and the Certification Providers that train and certify them.
- (b) **Industry Certification Threshold.** Mechanical Acceptance Test Technician and Employer certification requirements shall take effect when the Energy Commission finds that each of the following conditions are met. Until such time that 10-103-B(b)1 and 10-103-B(b)2 are met, Field Technicians are allowed to complete the acceptance test requirements in Section 120.5 without completing the Acceptance Test Technician certification requirements.

### **1. Number of Certified Acceptance Test Technicians.**

- A. There shall be no less than 300 Mechanical Acceptance Test Technicians certified to perform all of the acceptance tests in Building Energy Efficiency Standards, Section 120.5, except as provided in Subsection 10-103-B(b)1.B, below. The number of certified Mechanical Acceptance Test Technicians shall be demonstrated by Certification Provider-provided reports submitted to the Energy Commission.
- B. If there are less than 300 Mechanical Acceptance Test Technicians certified to perform all of the acceptance tests in Building Energy Efficiency Standards, Section 120.5, then there shall be at least 300 Mechanical Acceptance Test Technicians certified to complete the following tests:
- (i) NA7.5.1 Outdoor Air Ventilation Systems
  - (ii) NA7.5.2 Constant Volume, Single Zone Unitary Air Conditioners and Heat Pumps
  - (iii) NA7.5.4 Air Economizer Controls
  - (iv) NA7.5.5 Demand Control Ventilation Systems
  - (v) NA 7.5.6 Supply Fan Variable Flow Controls
  - (vi) NA7.5.7, NA7.5.9 Hydronic System Variable Flow Controls
  - (vii) NA7.5.10 Automatic Demand Shed Controls

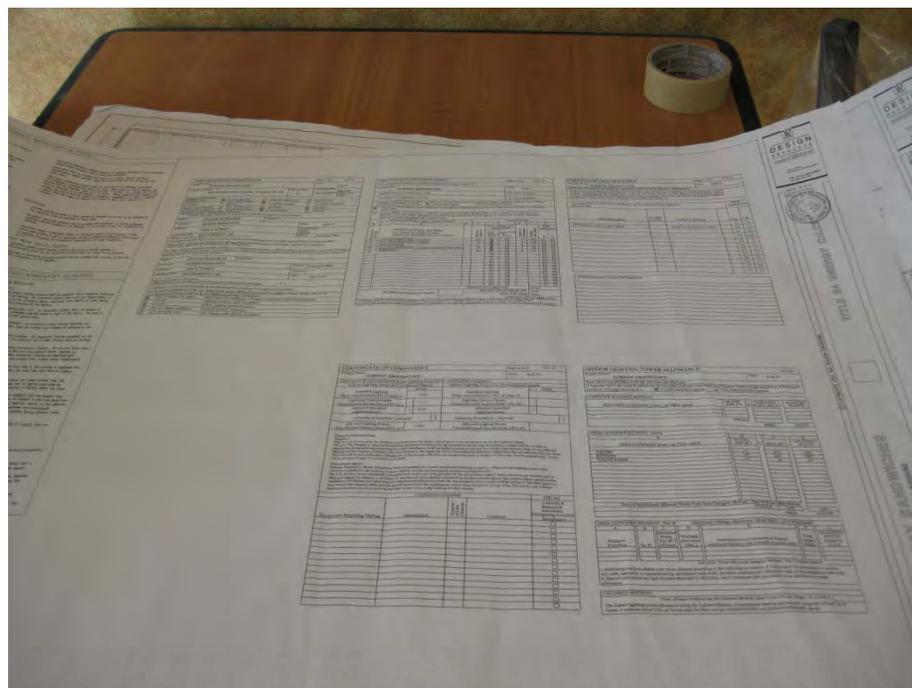
The number of certified Mechanical Acceptance Test Technicians shall be demonstrated by Certification Provider-provided reports submitted to the Energy Commission.

2. **Industry Coverage by Certification Provider(s).** The Mechanical Acceptance Test Technician Certification Provider(s) approved by the Energy Commission, in their entirety, provide reasonable access to certification for technicians representing the majority of the following industry groups: Professional engineers, HVAC installers, mechanical contractors, TAB certified technicians, controls installation and startup contractors and certified commissioning professionals who have verifiable training, experience and expertise in HVAC systems. The Energy Commission will determine reasonable access by considering factors such as certification costs commensurate with the complexity of the training being provided, certification marketing materials, prequalification criteria, class availability and curriculum.
- (c) **Qualifications and Approval of Certification Providers.** The Acceptance Test Technician Certification Providers (ATTCPs) shall submit a written application to the Energy Commission with a summary and the necessary background documents to explain how the following criteria and procedures have been met:



## §10-103 and the Plans Examiner

- **Still verify required Certificate of Compliance on plans**
  - NRCC-ENV forms
  - NRCC-MCH forms
  - NRCC-LTI forms
- **Verify all NRCCs are registered with a nonres. data registry starting 1/1/15**



# APPENDIX A Compliance Forms

<b>CERTIFICATE OF COMPLIANCE</b>			
NRCC-CXR-01-E	Commissioning Review	Enforce Agency	Certificate of Compliance - Cx Design Review Kickoff
NRCC-CXR-02-E	Commissioning Review	Enforce Agency	Certificate of Compliance - Cx Construction Documents-General
NRCC-CXR-03-E	Commissioning Review	Enforce Agency	Certificate of Compliance - Cx Construction Documents-Simple HVAC Systems
NRCC-CXR-04-E	Commissioning Review	Enforce Agency	Certificate of Compliance - Cx Construction Documents-Complex Mechanical Systems
NRCC-CXR-05-E	Commissioning Review	Enforce Agency	Certificate of Compliance - Cx Design Review Signature Page
NRCC-ELC-01-E	Electrical	Enforce Agency	Certificate of Compliance - Disaggregation of Electrical Circuits
NRCC-ENV-01-E	Envelope	Enforce Agency	Certificate of Compliance - Envelope Component Approach
NRCC-ENV-02-E	Envelope	Enforce Agency	Certificate of Compliance - Fenestration Worksheet
NRCC-ENV-03-E	Envelope	Enforce Agency	Certificate of Compliance - CoolRoof And SRI Worksheet
NRCC-ENV-04-E	Envelope	Enforce Agency	Certificate of Compliance - Daylit Zone Worksheet
NRCC-ENV-05-E	Envelope	Enforce Agency	Certificate of Compliance - FENESTRATION CERTIFICATE LABEL
NRCC-ENV-06-E	Envelope	Enforce Agency	Area Weighted Average Calculation Worksheet
NRCC-LTI-01-E	Lighting - Indoor	Enforce Agency	Certificate of Compliance and Field Inspection Checklist
NRCC-LTI-02-E	Lighting - Indoor	Enforce Agency	Certificate of Compliance - Lighting Controls Credit Worksheet
NRCC-LTI-03-E	Lighting - Indoor	Enforce Agency	Certificate of Compliance - Indoor Lighting Power Allowance
NRCC-LTI-04-E	Lighting - Indoor	Enforce Agency	Certificate of Compliance - Tailored Method Worksheet
NRCC-LTI-05-E	Lighting - Indoor	Enforce Agency	Certificate of Compliance - Line Voltage Track Lighting Worksheet
NRCC-LTO-01-E	Lighting - Outdoor	Enforce Agency	Certificate of Compliance - Outdoor Lighting

# APPENDIX A Compliance Forms

NRCC-LTO-02-E	Lighting - Outdoor	Enforce Agency	Certificate of Compliance - Outdoor Lighting Controls
NRCC-LTO-03-E	Lighting - Outdoor	Enforce Agency	Certificate of Compliance - Outdoor Lighting Power Allowance
NRCC-LTS-01-E	Lighting - Sign	Enforce Agency	Certificate of Compliance - Sign Lighting
NRCC-MCH-01-E	Mechanical	Enforce Agency	Certificate of Compliance - Declarations
NRCC-MCH-02-E	Mechanical	Enforce Agency	Certificate of Compliance - Requirements - Dry System and Wet System
NRCC-MCH-03-E	Mechanical	Enforce Agency	Certificate of Compliance - Mechanical Ventilation and Reheat
NRCC-MCH-04-E	Mechanical	Enforce Agency	Certificate of Compliance - Declarations - Single Zone Systems
NRCC-MCH-05-E	Mechanical	Enforce Agency	Certificate of Compliance - Requirements - Single Zone Systems
NRCC-MCH-06-E	Mechanical	Enforce Agency	Certificate of Compliance - Maximum Cycles of Concentration Worksheet
NRCC-PLB-01-E	Plumbing	Enforce Agency	Certificate of Compliance - Water Heating Systems
NRCC-PRC-01-E	Process	Enforce Agency	Certificate of Compliance - Covered Process
NRCC-PRC-02-E	Process	Enforce Agency	Certificate of Compliance - Garage Exhaust
NRCC-PRC-03-E	Process	Enforce Agency	Certificate of Compliance - Commercial Kitchens
NRCC-PRC-04-E	Process	Enforce Agency	Certificate of Compliance - Data Centers
NRCC-PRC-05-E	Process	Enforce Agency	Certificate of Compliance - Prescriptive/Performance Commercial Refrigeration
NRCC-PRC-06-E	Process	Enforce Agency	Certificate of Compliance - Refrigerated Warehouses
NRCC-PRC-07-E	Process	Enforce Agency	Certificate of Compliance - Refrigerated Warehouses - 3,000 ft <sup>2</sup> or greater

# APPENDIX A Compliance Forms

NRCC-PRC-08-E	Process	Enforce Agency	Certificate of Compliance - Refrigerated Warehouses - 3,000 ft <sup>2</sup> or greater and served by the same refrigeration system.
NRCC-PRC-09-E	Process	Enforce Agency	Certificate of Compliance - Laboratory Exhaust
NRCC-PRC-10-E	Process	Enforce Agency	Certificate of Compliance - Compressed Air Systems
NRCC-PRC-11-E	Process	Enforce Agency	Certificate of Compliance - Process Boilers
NRCC-SRA-01-E	Solar - Ready Area	Enforce Agency	Certificate of Compliance - Nonresidential Solar Ready Areas (Solar Radiation Availability)
NRCC-SRA-02-E	Solar - Ready Area	Enforce Agency	Certificate of Compliance - Minimum Solar Zone Area Worksheet
NRCC-STH-01-E	Solar - Thermal Heating	Enforce Agency	OG-100 Worksheet
<b>CERTIFICATE OF INSTALLATION</b>			
NRCI-ENV-01-E	Envelope	Enforce Agency	Certificate of Installation - Envelope
NRCI-ELC-01-E	Electrical	Enforce Agency	Certificate of Installation - Electrical Power Distribution
NRCI-LTI-01-E	Lighting - Indoor	Enforce Agency	Certificate of Installation - Validation of Certificate of Compliance
NRCI-LTI-02-E	Lighting - Indoor	Enforce Agency	Certificate of Installation - Energy Management Control System or Lighting Control System
NRCI-LTI-03-E	Lighting - Indoor	Enforce Agency	Certificate of Installation - Line-Voltage Track Lighting
NRCI-LTI-04-E	Lighting - Indoor	Enforce Agency	Certificate of Installation - Two Interlocked Lighting Systems
NRCI-LTI-05-H	Lighting - Indoor	<b>HERS</b> Rater	Certificate of Installation - Power Adjustment Factors
NRCI-LTI-06-E	Lighting - Indoor	Enforce Agency	Certificate of Installation - Additional Videoconference Studio Lighting
NRCI-LTO-01-E	Lighting - Outdoor	Enforce Agency	Certificate of Installation - Outdoor Lighting
NRCI-LTO-02-E	Lighting - Outdoor	Enforce Agency	Certificate of Installation - EMCS - Lighting Control System
NRCI-LTS-01-E	Lighting - Sign	Enforce Agency	Certificate of Installation - Sign Lighting

# APPENDIX A Compliance Forms

NRCI-MCH-01-E	Mechanical	Enforce Agency	Certificate of Installation - Mechanical
NRCI-PLB-01-E	Plumbing	Enforce Agency	Certificate of Installation - Water Heating Systems
NRCI-PLB-02-E	Plumbing	Enforce Agency	Single Dwelling Unit Hot Water System Distribution.
NRCI-PLB-03-E	Plumbing	Enforce Agency	Multifamily Central Hot Water System Distribution - NON-HERS
NRCI-PLB-21-H	Plumbing	<b>HERS</b> Rater	Certificate of Installation - Water Heating System Distribution - HERS
NRCI-PRC-01-E	Process	Enforce Agency	Certificate of Installation - Refrigerated Warehouse
NRCI-SPV-01-E	Solar - Photovoltaic	Enforce Agency	Certificate of Installation - Solar Photovoltaic System
NRCI-STH-01-E	Solar - Thermal Heating	Enforce Agency	Certificate of Installation - Solar Water Heating System
<b>CERTIFICATE OF ACCEPTANCE</b>			
NRCA-ENV-02-F	Envelope	Field Tech	Fenestration Acceptance
NRCA-LTI-02-A	Lighting - Indoor	Accept Tech	Lighting Controls
NRCA-LTI-03-A	Lighting - Indoor	Accept Tech	Automatic Daylighting
NRCA-LTI-04-A	Lighting - Indoor	Accept Tech	Demand Responsive Lighting Controls
NRCA-LTO-02-A	Lighting - Outdoor	Accept Tech	Outdoor Motion Sensor and Lighting Shut-off Controls
NRCA-MCH-02-A	Mechanical	Accept Tech	Outdoor Air
NRCA-MCH-03-A	Mechanical	Accept Tech	Constant Volume Single Zone HVAC
NRCA-MCH-04-H	Mechanical	<b>HERS</b> Rater	Air Distribution Duct Leakage Testing
NRCA-MCH-05-A	Mechanical	Accept Tech	Air Economizer Controls
NRCA-MCH-06-A	Mechanical	Accept Tech	Demand Control Ventilation (DVC)
NRCA-MCH-07-A	Mechanical	Accept Tech	Supply Fan Variable Flow Controls (VFC)

# APPENDIX A Compliance Forms

NRCA-MCH-08-A	Mechanical	Accept Tech	Valve Leakage Test
NRCA-MCH-09-F	Mechanical	Field Tech	Supply Water Temperature Reset Controls
NRCA-MCH-10-A	Mechanical	Accept Tech	Hydronic System Variable Flow Controls
NRCA-MCH-11-A	Mechanical	Accept Tech	Automatic Demand Shed Controls
NRCA-MCH-12-F	Mechanical	Field Tech	Fault Detection & Diagnostics for DX Units
NRCA-MCH-13-F	Mechanical	Field Tech	Automatic Fault Detection & Diagnostics for Air Handling & Zone Terminal Units
NRCA-MCH-14-F	Mechanical	Field Tech	Distributed Energy Storage DX AC Systems Test
NRCA-MCH-15-F	Mechanical	Field Tech	Thermal Energy Storage (TES) Systems
NRCA-MCH-16-F	Mechanical	Field Tech	Supply Air Temperature Reset Controls
NRCA-MCH-17-F	Mechanical	Field Tech	Condenser Water Temperature Reset Controls
NRCA-MCH-18-F	Mechanical	Field Tech	Energy Management Control System
NRCA-PRC-01-F	Process	Field Tech	Compressed Air Systems
NRCA-PRC-02-F	Process	Field Tech	Commercial Kitchen Exhaust
NRCA-PRC-03-F	Process	Field Tech	Parking Garage Exhaust
NRCA-PRC-04-F	Process	Field Tech	Refrigerated Warehouse-Evaporator Fan Motor Controls
NRCA-PRC-05-F	Process	Field Tech	Refrigerated Warehouse-Evaporative Condenser Controls
NRCA-PRC-06-F	Process	Field Tech	Refrigerated Warehouse-Air-Cooled Condenser Controls
NRCA-PRC-07-F	Process	Field Tech	Refrigerated Warehouse - Variable Speed Compressor
NRCA-PRC-08-F	Process	Field Tech	Refrigerated Warehouse-Electric Resistance Underslab Heating System
<b>CERTIFICATE OF VERIFICATION</b>			

# APPENDIX A Compliance Forms

NRCV-MCH-04a-H	Mechanical	<b>HERS</b> Rater	Duct Leakage Measurement - New System
NRCV-MCH-04c-H	Mechanical	<b>HERS</b> Rater	Duct Leakage Measurement - Low Leakage Air-Handling Units
NRCV-MCH-04d-H	Mechanical	<b>HERS</b> Rater	Duct Leakage Measurement - – Altered (Existing) System
NRCV-MCH-04e-H	Mechanical	<b>HERS</b> Rater	Duct Leakage Measurement - Sealing of All Accessible Leaks
NRCV-PLB-21-H	Plumbing	<b>HERS</b> Rater	NonRes Certificate of Verification - Plumbing -Domestic Hot Water Distribution - HERS



# §10-103 and the Field Inspector

- At Final, verify Doc. Author signature on Certificate of:
  - Installation (NRCI)
  - Acceptance (NRCA)
  - Field Verification and Diagnostic Testing (NRCV)
- Verify LTI and MCH NRCA forms are signed by certified Field Technician when req.
- Verify all forms are registered with nonres. data registry starting 1/1/15

STATE OF CALIFORNIA  
ENERGY MANAGEMENT CONTROL SYSTEM OR LIGHTING CONTROL SYSTEM  
CERTIFICATE OF INSTALLATION (Page 5 of 5)

Energy Management Control System or Lighting Control System

Project Name: 2013 CALBO Training Campus | Measurement Agency: LOR&J Architects | Permit Number: 09814

Project Address: 2013 CALBO Drive | City: Sacramento | Zip Code: 95814

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

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

**DOCUMENTATION AUTHOR'S DECLARATION STATEMENT**

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

Documentation Author Name: <b>Best Doc. Author</b>	Documentation Author Signature: <i>Best Doc. Author</i>
Documentation Author Company Name: <b>Energy Savers Inc.</b>	Date Signed: <b>1/1/2014</b>
Address: <b>1516 9<sup>th</sup> Street</b>	CSB NRCA Certification Identification (if applicable): <b>N/A</b>
City/State/Zip: <b>Sacramento, CA 95814</b>	Phone: <b>(916) 362-4719</b>

**RESPONSIBLE PERSON'S DECLARATION STATEMENT**

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

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

Responsible Builder/Installer Name: <b>Mr. Lighting Contractor</b>	Responsible Builder/Installer Signature: <i>Mr. Lighting Contractor</i>	
Company Name: (Installing Subcontractor or General Contractor or Builder/Owner) <b>Best Lighting Comp.</b>	Position With Company (Title): <b>Owner</b>	
Address: <b>123 Edison Street</b>	CSB License: <b>010113</b>	
City/State/Zip: <b>Sacramento, CA 95814</b>	Phone: <b>(916) 461-8528</b>	Date Signed: <b>1/1/2014</b>

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance June 2013



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

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

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

<b>DOCUMENTATION AUTHOR'S DECLARATION STATEMENT</b>		
1. I certify that this Certificate of Installation documentation is accurate and complete.		
Documentation Author Name: <b>Best Doc. Author</b>	Documentation Author Signature: <i>Best Doc. Author</i>	
Documentation Author Company Name: <b>Energy Savers Inc.</b>	Date Signed: <b>1/1/2014</b>	
Address: <b>1516 9<sup>th</sup> Street</b>	CEA/ HERS Certification Identification (if applicable): <b>N/A</b>	
City/State/Zip: <b>Sacramento, CA 95814</b>	Phone: <b>(916) 362-4719</b>	
<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>		
I certify the following under penalty of perjury, under the laws of the State of California:		
1. The information provided on this Certificate of Installation is true and correct.		
2. I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction, or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Installation and attest to the declarations in this statement (responsible builder/installer), otherwise I am an authorized representative of the responsible builder/installer.		
3. The constructed or installed features, materials, components or manufactured devices (the installation) identified on this Certificate of Installation conforms to all applicable codes and regulations, and the installation conforms to the requirements given on the plans and specifications approved by the enforcement agency.		
4. I reviewed a copy of the Certificate of Compliance approved by the enforcement agency that identifies the specific requirements for the scope of construction or installation identified on this Certificate of Installation, and I have ensured that the requirements that apply to the construction or installation have been met.		
5. I will ensure that a completed signed copy of this Certificate of Installation shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Installation is required to be included with the documentation the builder provides to the building owner at occupancy.		
Responsible Builder/Installer Name: <b>Mr. Lighting Contractor</b>	Responsible Builder/Installer Signature: <i>Mr. Lighting Contractor</i>	
Company Name: (Installing Subcontractor or General Contractor or Builder/Owner) <b>Best Lighting Comp.</b>	Position With Company (Title): <b>Owner</b>	
Address: <b>123 Edison Street</b>	CSLB License: <b>010113</b>	
City/State/Zip: <b>Sacramento, CA 95814</b>	Phone (916) 481-8528	Date Signed: <b>1/1/2014</b>

**OUTDOOR AIR ACCEPTANCE**

CEC-NRCA-MCH-02-A (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF ACCEPTANCE		NRCA-MCH-02-A
Outdoor Air Acceptance		(Page 3 of 4)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010114</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

<b>DOCUMENTATION AUTHOR'S DECLARATION STATEMENT</b>		
<ul style="list-style-type: none"> <li>I certify that this Certificate of Acceptance documentation is accurate and complete.</li> </ul>		
Documentation Author Name:	Documentation Author Signature:	
Documentation Author Company Name:	Date Signed:	
Address:	CEA/HERS/ATT Certification Identification (If applicable):	
City/State/Zip:	Phone:	
<b>FIELD TECHNICIAN'S DECLARATION STATEMENT</b>		
I certify the following under penalty of perjury, under the laws of the State of California:		
<ol style="list-style-type: none"> <li>The information provided on this Certificate of Acceptance is true and correct.</li> <li>I am the person who performed the acceptance verification reported on this Certificate of Acceptance (Field Technician).</li> <li>The construction or installation identified on this Certificate of Acceptance complies with the applicable acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA7.</li> <li>I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and signed by the responsible builder/installer and has been posted or made available with the building permit(s) issued for the building.</li> </ol>		
Field Technician Name: <b>MECH Field Tech Guy</b>	Field Technician Signature: <i>MECH Field Tech Guy</i>	
Field Technician Company Name: <b>MECH Field Test Comp.</b>	Position with Company (Title): <b>Owner</b>	
Address: <b>345 Test Street</b>	ATT Certification Identification (if applicable): <b>NEBB/TABB Cert. #: 01012014</b>	
City/State/Zip: <b>Sacramento, CA 95814</b>	Phone: <b>(916) 813-2451</b>	Date Signed: <b>1/1/2014</b>
<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>		
I certify the following under penalty of perjury, under the laws of the State of California:		
<ol style="list-style-type: none"> <li>I am the Field Technician, or the Field Technician is acting on my behalf as my employee or my agent and I have reviewed the information provided on this Certificate of Acceptance.</li> <li>I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Acceptance and attest to the declarations in this statement (responsible acceptance person).</li> <li>The information provided on this Certificate of Acceptance substantiates that the construction or installation identified on this Certificate of Acceptance complies with the acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA7.</li> <li>I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and is posted or made available with the building permit(s) issued for the building.</li> <li>I will ensure that a completed, signed copy of this Certificate of Acceptance shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a signed copy of this Certificate of Acceptance is required to be included with the documentation the builder provides to the building owner at occupancy.</li> </ol>		
Responsible Acceptance Person Name:	Responsible Acceptance Person Signature:	
Responsible Acceptance Person Company Name:	Position with Company (Title):	
Address:	CSLB License:	



*Let's talk about the changes  
to the Energy Standards –  
Mandatory Measures*



# Which § are the Mandatory Measures?

## 2008 Standards

- §110 – §119 (all bldgs.)
- §116 – §118 (Env)
- §120 – §122 (Mech)
- §126 (Refrig. Warehouses)
- §130 – §131 (Indoor LTG)
- § in TABLE 100-A

## 2013 Standards

- §110.10 (Solar ready)
- §120.6 (Covered processes)
- §120.7 (Mand. Insulation)
- §120.8 (Bldg. Commissioning)
- §130.4 (LTI Inst. Cert.)
- §130.5 (Elect. Power Systems)
- § in TABLE 100.0-A

TABLE 100.0-A APPLICATION OF STANDARDS

Occupancies	Application	Mandatory	Prescriptive	Performance	Additions/Alterations
General Provisions		100.0, 100.1, 100.2, 110.0, 110.10			
Nonresidential, High-Rise Residential, And Hotels/Motels	General	140.0	140.2	140.1	141.0
	Envelope (conditioned)	110.6, 110.7, 110.8,120.7	140.3		
	Envelope (unconditioned process spaces)	N.A.	140.3(c)		
	HVAC (conditioned)	110.2, 110.5, 120.0-120.5, 120.8	140.4		
	Water Heating	110.3, 120.3, 120.8	140.5		
	Indoor Lighting (conditioned, process spaces)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6	N.A.	N.A.
	Indoor Lighting (unconditioned and parking garages)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6		
	Outdoor Lighting	110.9, 130.0, 130.2, 130.4	140.7		
	Building Electrical Power	130.5	N.A.		
	Pool and Spa Systems	110.4, 150.0(p)	N.A.		
Solar Ready Buildings	110.10	N.A.	N.A.	N.A.	
Covered Processes <sup>1</sup>	Envelope, Ventilation, Process Loads	110.2, 120.6, 120.8	140.9	140.1	120.6, 140.9
Signs	Indoor and Outdoor	130.0, 130.3	140.8	N.A.	141.0
Low-Rise Residential	General	150.0	150.1(a, c)	150.1(a, b)	150.2
	Envelope (conditioned)	110.6, 110.7, 110.8, 150.0(a-e, g, l)			
	HVAC (conditioned)	110.2, 110.5, 150.0(h, i, m, o)			
	Water Heating	110.3, 150.0(j, n)			
	Indoor Lighting (conditioned, unconditioned and parking garages)	110.9, 130.0, 150.0(k)			
	Outdoor Lighting	110.9, 130.0,150.0(k)			
	Pool and Spa Systems	110.4, 150.0(p)	N.A.	N.A.	N.A.
Solar Ready Buildings	110.10	N.A.	N.A.	N.A.	
<sup>1</sup> Nonresidential, high-rise and hotel/motel buildings that contain covered processes may conform to the applicable requirements of both occupancy types listed in this table.					



## Solar Ready

- **New Mandatory measures in §110.10**
- **Applicable to hotel/motel and high-rise multi-family buildings  $\leq 10$  stories; and all other nonres. buildings  $\leq 3$  stories**
- **Requirements for:**
  - Solar zone (location and area)
  - Orientation and Shading
  - Interconnection pathways
  - Structural Design Loads
  - Main electrical service panel

---

## SECTION 110.10 – MANDATORY REQUIREMENTS FOR SOLAR READY BUILDINGS

### (a) Covered Occupancies.

1. **Single Family Residences.** Single family residences located in subdivisions with ten or more single family residences and where the application for a tentative subdivision map for the residences has been deemed complete, by the enforcement agency, on or after January 1, 2014, shall comply with the requirements of Section 110.10(b) through 110.10(e).
2. **Low-rise Multi-family Buildings.** Low-rise multi-family buildings shall comply with the requirements of Section 110.10(b) through 110.10(d).
3. **Hotel/Motel Occupancies and High-rise Multi-family Buildings.** Hotel/motel occupancies and high-rise multi-family buildings with ten stories or fewer shall comply with the requirements of Section 110.10(b) through 110.10(d).
4. **All Other Nonresidential Buildings.** All other nonresidential buildings with three stories or fewer shall comply with the requirements of Section 110.10(b) through 110.10(d).

### (b) Solar Zone.

1. **Minimum Area.** The solar zone shall have a minimum total area as described below. The solar zone shall comply with access, pathway, smoke ventilation, and spacing requirements as specified in Title 24, Part 9 or other Parts of Title 24 or in any requirements adopted by a local jurisdiction. The solar zone total area shall be comprised of areas that have no dimension less than five feet and are no less than 80 square feet each for buildings with roof areas less than or equal to 10,000 square feet or no less than 160 square feet each for buildings with roof areas greater than 10,000 square feet.

- A. **Single Family Residences.** The solar zone shall be located on the roof or overhang of the building and have a total area no less than 250 square feet.

**EXCEPTION 1 to Section 110.10(b)1A:** Single family residences with a permanently installed solar electric system having a nameplate DC power rating, measured under Standard Test Conditions, of no less than 1000 watts.

**EXCEPTION 2 to Section 110.10(b)1A:** Single family residences with a permanently installed domestic solar water-heating system meeting the installation criteria specified in the Reference Residential Appendix RA4 and with a minimum solar savings fraction of 0.50.

**EXCEPTION 3 to Section 110.10(b)1A:** Single family residences with three stories or more and with a total floor area less than or equal to 2000 square feet and having a solar zone total area no less than 150 square feet.

**EXCEPTION 4 to Section 110.10(b)1A:** Single family residences located in Climate zones 8-14 and the Zildland-Urban Interface Fire Area as defined in Title 24, Part 2 and having a whole house fan and having a solar zone total area no less than 150 square feet.

**EXCEPTION 5 to Section 110.10(b)1A:** Buildings with a designated solar zone area that is no less than 50 percent of the potential solar zone area. The potential solar zone area is the total area of any low-sloped roofs where the annual solar access is 70 percent or greater and any steep-sloped roofs oriented between 110 degrees and 270 degrees of true north where the annual solar access is 70 percent or greater. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

**EXCEPTION 6 to Section 110.10(b)1A:** Single family residences having a solar zone total area no less than 150 square feet and where all thermostats comply with Reference Joint Appendix JA5 and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.

**EXCEPTION 7 to Section 110.10(b)1A:** Single family residences meeting the following conditions:

- A. All thermostats comply with Reference Joint Appendix JA5 and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.
- B. All applicable requirements of Section 150.0(k), except as required below:
  - i. All permanently installed indoor lighting is high efficacy as defined in TABLE 150.0-A or 150.0-B and is installed in kitchens, bathrooms, utility rooms, and garages at a minimum.
  - ii. All permanently installed lighting in bathrooms is controlled by a vacancy sensor.

**EXCEPTION to EXCEPTION 7Bii:** One high efficacy luminaire as defined in TABLE 150.0-A or 150.0-B with total lamp wattage rated to consume no greater than 26 watts of power is not required to be controlled by a vacancy sensor.

- iii. Every room which does not have permanently installed lighting has at least one switched receptacle installed.
- iv. Permanently installed night lights complying with Section 150.0(k)1E are allowed.
- v. Lighting integral to exhaust fans complying with Section 150.0(k)1F is allowed.
- vi. All permanently installed outdoor lighting is high efficacy as defined in TABLE 150.0-A or 150.0-B and is controlled as required in Section 150.0(k)9Ai and iii.

- B. **Low-rise and High-rise Multi-family Buildings, Hotel/Motel Occupancies, and Nonresidential Buildings.** The solar zone shall be located on the roof or overhang of the building or on the roof or overhang of another structure located within 250 feet of the building or on covered parking installed with the building project and have a total area no less than 15 percent of the total roof area of the building excluding any skylight area.

**EXCEPTION 1 to Section 110.10(b)1B:** Buildings with a permanently installed solar electric system having a nameplate DC power rating, measured under Standard Test Conditions, of no less than one watt per square foot of roof area.

**EXCEPTION 2 to Section 110.10(b)1B:** Buildings with a permanently installed domestic solar water-heating system complying with Section 150.1(c)8Ciii.

**EXCEPTION 3 to Section 110.10(b)1B:** Buildings with a designated solar zone area that is no less than 50 percent of the potential solar zone area. The potential solar zone area is the total area of any low-sloped roofs where the annual solar access is 70 percent or greater and any steep-sloped roofs oriented between 110 degrees and 270 degrees of true north where the annual solar access is 70 percent or greater. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

**EXCEPTION 4 to Section 110.10(b)1B:** Low-rise and high-rise multi-family buildings meeting the following conditions:

- A. All thermostats in each dwelling unit comply with Reference Joint Appendix JA5 and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.
- B. All applicable requirements of Section 150.0(k), except as required below:
  - i. All permanently installed indoor lighting in each dwelling unit is high efficacy as defined in TABLE 150.0-A or 150.0-B and is installed in kitchens, bathrooms, utility rooms, and private garages at a minimum.
  - ii. All permanently installed lighting in bathrooms is controlled by a vacancy sensor.

**EXCEPTION to EXCEPTION 4Bii:** One high efficacy luminaire as defined in TABLE 150.0-A or 150.0-B with total lamp wattage rated to consume no greater than 26 watts of power is not required to be controlled by a vacancy sensor.

- iii. Every room which does not have permanently installed lighting has at least one switched receptacle installed.
- iv. Permanently installed night lights complying with Section 150.0(k)1E are allowed.
- v. Lighting integral to exhaust fans complying with Section 150.0(k)1F is allowed.
- vi. All permanently installed outdoor lighting for private patios, entrances, balconies, and porches is high efficacy as defined in TABLE 150.0-A or 150.0-B and is controlled as required in Section 150.0(k)9Ai and iii.

**EXCEPTION 5 to Section 110.10(b)1B:** Buildings where the roof is designed and approved to be used for vehicular traffic or parking or for a heliport.

- 2. **Orientation.** All sections of the solar zone located on steep-sloped roofs shall be oriented between 110 degrees and 270 degrees of true north.
- 3. **Shading.**
  - A. No obstructions, including but not limited to, vents, chimneys, architectural features, and roof mounted equipment, shall be located in the solar zone.
  - B. Any obstruction, located on the roof or any other part of the building that projects above a solar zone shall be located at least twice the distance, measured in the horizontal plane, of the height difference between the highest point of the obstruction and the horizontal projection of the nearest point of the solar zone, measured in the vertical plane.

**EXCEPTION to Section 110.10(b)3:** Any obstruction, located on the roof or any other part of the building, that is oriented north of all points on the solar zone.

- 4. **Structural Design Loads on Construction Documents.** For areas of the roof designated as solar zone, the structural design loads for roof dead load and roof live load shall be clearly indicated on the construction documents.

**NOTE:** Section 110.10(b)4 does not require the inclusion of any collateral loads for future solar energy systems.

(c) **Interconnection Pathways.**

- 1. The construction documents shall indicate a location for inverters and metering equipment and a pathway for routing of conduit from the solar zone to the point of interconnection with the electrical service. For single family residences the point of interconnection will be the main service panel.
- 2. The construction documents shall indicate a pathway for routing of plumbing from the solar zone to the water-heating system.

- (d) **Documentation.** A copy of the construction documents or a comparable document indicating the information from Sections 110.10(b) through 110.10(c) shall be provided to the occupant.

(e) **Main Electrical Service Panel.**

- 1. The main electrical service panel shall have a minimum busbar rating of 200 amps.
- 2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future solar electric installation.
  - A. **Location.** The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.
  - B. **Marking.** The reserved space shall be permanently marked as “For Future Solar Electric”.



# §110.10 and the Plans Examiner

- **NRCC-SRA-01 form**
  - Ident. if meeting solar zone reqs. or exception
- **NRCC-SRA-02 form**
  - Solar zone worksheet req. if not exempt
- **Verify specs. on plans**

**NRCC-SRA-02-E**

**Step 1: Determine Minimum Solar Zone Area**

Calculate the minimum solar zone area using one of the two options provided below. Use option 2 if your roof and overhangs are shaded.

**Method 1: Minimum Solar Zone Area Based on Total Roof Area<sup>1</sup> requirements in 110.10(b)(1)(B)**

Free Construction: Total roof area (sqft)	A	2,200 ft <sup>2</sup>
Additions: Total roof area added to building (sqft)	B	200 ft <sup>2</sup>
Additions: Area of new roof area covered with skylights (sqft)	C = 0.15 x (A - B)	300 ft <sup>2</sup>
Minimum solar zone area	F = 0.3 x (A - B)	

*Note: For additions, if A is 2,000 ft<sup>2</sup> then addition does not need to comply with solar zone requirements.*

**Method 2: Minimum Solar Zone Area Based on Potential Solar Zone<sup>2</sup> (requirements in Exception 1 to 110.10(b)(1)(B))**

The enforcement agency may require additional documentation that describes how the reduced solar zone area was determined.

Method/Tool(s) used to quantify annual solar access: (for example, "Software 1", "CAD Tool 1")	D	
Area of over-sloped roof (ratio of rise to run of 2:11 or less) where the annual solar access is 70 percent or greater. <sup>3</sup> (sqft)	E	
Area of steep-sloped roof (ratio of rise to run is greater than 2:11) that is oriented between 130 and 270 degrees and annual solar access is 70 percent or greater. <sup>4</sup> (sqft)	F = 0.3 x (D + E)	
Minimum solar zone area	G	

<sup>1</sup>For new construction consider total roof area; for additions consider newly added roof area.

<sup>2</sup>Minimum solar zone area (either C or F) (sqft)



<b>CERTIFICATE OF COMPLIANCE</b>	<b>NRCC-SRA-01-E</b>
Solar-Ready Areas	(Page 1 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>

<b>General Information</b>	
Project Address:	
<b>Building Type:</b>	
<input type="checkbox"/> Hotel/Motel building with ten stories or fewer	<input type="checkbox"/> High-rise multi-family building with ten stories or fewer
<input checked="" type="checkbox"/> Other nonresidential building with three stories or fewer	
<b>Solar-ready requirements do not apply to hotel/motel buildings and high-rise multifamily building with more than ten stories or other nonresidential buildings with more than three stories.</b>	
<b>Type of Construction:</b>	
<input checked="" type="checkbox"/> New Construction	<input type="checkbox"/> Addition that increases roof area by more than 2,000 ft <sup>2</sup>
<b>Solar-ready requirements do not apply to alterations or additions that increase the roof area by 2,000 ft<sup>2</sup> or less.</b>	

<b>Solar-Ready Choose Path A, B, C, D, or E from below</b>	
<input checked="" type="checkbox"/> <b>A. Allocated Solar Zone</b>	
NRCC-SRA-02-E Minimum Solar Zone Area Worksheet is required to be submitted	
<b>Minimum Solar Zone Area (sqft)</b> This is quantity [G] from NRCC-SRA-02-E Minimum Solar Zone Area Worksheet	<b>300 ft<sup>2</sup></b>
<b>Proposed Solar Zone Area (sqft)</b> This is quantity [S] from NRCC-SRA-02-E Minimum Solar Zone Area Worksheet	<b>300 ft<sup>2</sup></b>
The construction documents will indicate a location for inverters and metering equipment and a pathway for routing of conduit from the solar zone to the point of interconnection with the electrical service. The construction documents will indicate a pathway for routing of plumbing from the solar zone to the water heating system.	
A copy of the construction documents or a comparable document indicating information about the solar zone and interconnection pathways will be provided to the occupant.	
If the installer certifies that all above requirements have been met and the Proposed Solar Zone Area meets or exceeds the Minimum Solar Zone Area, the building complies, otherwise it does not comply. <input type="checkbox"/> does not comply <input checked="" type="checkbox"/> complies	

<input type="checkbox"/> <b>B. Permanently Installed Solar Photovoltaic (PV) System</b>	
<b>Total Roof Area (sqft)*</b> [A]	<b>Minimum Nameplate DC Power Rating (watts)</b> [B] = A x 1watt/ft <sup>2</sup>
* New construction: report total roof area; Additions: report newly added roof area	
Will the proposed building have a permanently installed solar electric system that meets or exceeds the Minimum Nameplate DC Power Rating? <input type="checkbox"/> Yes <input type="checkbox"/> No	
If yes, a NRCI-SPV-01-E Certificate of Installation: Solar Photovoltaic System documenting the installed system must be submitted as a condition of final approval.	
<b>Please check box to right if answered yes to all questions in this section.</b> <input type="checkbox"/> EXEMPT	

<input type="checkbox"/> <b>C. Permanently Installed Solar Water Heating System</b>	
Will the building have a permanently installed solar water heating system? <input type="checkbox"/> Yes <input type="checkbox"/> No	
If yes, a NRCI-STH-01-E Certificate of Installation: Solar Water Heating System documenting the installed system must be submitted as condition of final approval.	
Is the annual solar savings fraction equal to or greater than 0.2 in climate zones 1 through 9 or 0.35 in climate zones 10 through 16? <input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Annual Solar Savings Fraction</b>	<b>How was Annual Solar Savings Fraction Calculated?</b>
<b>Please check box to right if answered yes to all questions in this section.</b> <input type="checkbox"/> EXEMPT	

**SOLAR READY AREAS**

CEC-NRCC-SRA-01-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE		NRCC-SRA-01-E
Solar-Ready Areas		(Page 2 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>	

<b>D. Thermostats and High Efficacy Lighting</b>	
Is the building a high-rise multifamily building with ten or stories or fewer?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Will all thermostats in each dwelling unit comply with Reference Joint Appendix 5 (JA5) and will they be capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Will all installed luminaires be classified as high efficacy in accordance with the applicable requirements in Section 130.0(c), and in accordance with TABLE 150.0-A or TABLE 150.0-B?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Please check box to right if answered yes to all questions in this section. <span style="float: right;"><input type="checkbox"/> EXEMPT</span>	

<b>E. Roof is Designed for Vehicle Traffic or Parking or for Heliport</b>	
Will the roof be designed and approved to be used for vehicular traffic or parking or for a heliport.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Please provide building plan reference _____.	
Please check box to right if answered yes to all questions in this section. <span style="float: right;"><input type="checkbox"/> EXEMPT</span>	

<b>DOCUMENTATION AUTHOR'S DECLARATION STATEMENT</b>	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Company:	Signature Date:
Address:	CEA/ HERS Certification Identification (if applicable):
City/State/Zip:	Phone:

<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> <li>The information provided on this Certificate of Compliance is true and correct.</li> <li>I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).</li> <li>The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.</li> <li>The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.</li> <li>I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.</li> </ol>	
Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip:	Phone:

<b>Instructions to Applicant Solar-ready Compliance &amp; Worksheets</b>	
(check box if worksheet are included)	
<input checked="" type="checkbox"/>	NRCC-SRA-01-E Certificate of Compliance: Solar-ready Area. <i>Required all submittals.</i>
<input checked="" type="checkbox"/>	NRCC-SRA-02-E Certificate of Compliance: Minimum Solar Zone Area Worksheet. <i>Required for compliance path A.</i>
<input type="checkbox"/>	NRCI-SPV-01-E Certificate of Installation: Solar Photovoltaic System <i>Required for compliance path B.</i>
<input type="checkbox"/>	NRCI-STH-01-E Certificate of Installation: Solar Water Heating System <i>Required for compliance path C.</i>

**MINIMUM SOLAR ZONE AREA WORKSHEET**

CEC-NRCC-SRA-02-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE	NRCC-SRA-02-E
Minimum Solar Zone Area Worksheet	(Page 1 of 3)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>

**Solar Zone Area (requirements in §110.10(b)1B)**

This worksheet applies to hotel/motel occupancies and high-rise multifamily buildings with ten stories or fewer, and all other nonresidential buildings with three stories or fewer that comply with the solar zone requirement through compliance path A: allocated solar zone.

The worksheet applies to all additions that increase the roof area by more than 2000 ft<sup>2</sup>.

**General Information****Project Address: 2013 CALBO Drive**
**Total Roof Area:**  Less than or equal to 10,000 ft<sup>2</sup>  
 Greater than 10,000 ft<sup>2</sup>
**Phase of Construction:**  New Construction  
 Addition that increases roof area by more than 2,000 ft<sup>2</sup>
**Step 1: Determine Minimum Solar Zone Area**

Calculate the minimum solar zone area using one of the two options provided below. Use option 2 if your roofs and overhangs are shaded.

**Method 1: Minimum Solar Zone Area Based on Total Roof Area (requirements in 110.10(b)1B)**

New Construction: Total roof area (sqft)	A	<b>2,200 ft<sup>2</sup></b>
Additions: Total roof area added to building (sqft)		
New Construction: Area of roof covered with skylights(sqft)	B	<b>200 ft<sup>2</sup></b>
Additions: Area of new roof area covered with skylights(sqft)		
Minimum solar zone area	$C = 0.15 \times (A - B)$	<b>300 ft<sup>2</sup></b>

Note: For additions, if  $A \leq 2,000 \text{ ft}^2$  then addition does not need to comply with solar zone requirements

**Method 2: Minimum Solar Zone Area Based on Potential Solar Zone ( requirements in Exception 3 to 110.10(b)1B)**

The enforcement agency may require additional documentation that describes how the reduced solar zone area was determined.

Method/Tool(s) used to quantify annual solar access: (for example, "Software X", "CAD Tool Y")		
Area of low-sloped roof (ratio of rise to run of 2:12 or less) where the annual solar access is 70 percent or greater.* (sqft)	D	
Area of steep-sloped roof (ratio of rise to run is greater than 2:12) that is oriented between 110 and 270 degrees and annual solar access is 70 percent or greater.* (sqft)	E	
Minimum solar zone area	$F = 0.5 \times (D + E)$	

\* For new construction consider total roof area; for additions consider newly added roof area

Minimum solar zone area (either C or F) (sqft)	G	
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# MINIMUM SOLAR ZONE AREA WORKSHEET

CEC-NRCC-SRA-02-E (Revised 06/13)



<b>CERTIFICATE OF COMPLIANCE</b>	<b>NRCC-SRA-02-E</b>
Minimum Solar Zone Area Worksheet	(Page 2 of 3)
Project Name:	Date Prepared:

## Step 2: Allocated Solar Zone Subareas

Subarea ID	Building Plan Reference	Slope of Roof or Overhang	If Steep Slope, roof or overhang oriented between 110 and 270 degrees	Subarea complies with Part 9 of Title 24 <sup>A</sup>	Subarea is free of obstructions <sup>B</sup>	Subarea is located the appropriate distance from obstructions <sup>C</sup>	Smallest dimension is greater than 5 feet	Subarea meet minimum area requirement <sup>D</sup>	Subarea Qualifies <sup>E</sup>	Area (sqft)
H	I	J	K	L	M	N	O	P	Q	R
1	S.3	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Steep	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	150 ft <sup>2</sup>
2	S.3	<input checked="" type="checkbox"/> Low <input type="checkbox"/> Steep	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	150 ft <sup>2</sup>
		<input type="checkbox"/> Low <input type="checkbox"/> Steep	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
		<input type="checkbox"/> Low <input type="checkbox"/> Steep	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
		<input type="checkbox"/> Low <input type="checkbox"/> Steep	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
		<input type="checkbox"/> Low <input type="checkbox"/> Steep	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
		<input type="checkbox"/> Low <input type="checkbox"/> Steep	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Proposed Solar Zone Area (sqft) (sum of all qualifying subareas) [S]</b>										

- A. The solar zone shall comply with access, pathway, smoke ventilation, and spacing requirements as specified in Title 24, Part 9 or other Parts of Title 24 or in any requirements adopted by a local jurisdiction.
- B. No obstructions, including but not limited to, vents, chimneys, architectural features, and roof mounted equipment, shall be located in the solar zone.
- C. Solar zone must be located no closer than twice the distance, measured in the horizontal plane, of the height difference between the highest point of the obstruction and the horizontal projection of the nearest point of the solar zone, measured in the vertical plane.
- D. If building roof area ≤ 10,000 ft<sup>2</sup> then minimum area is 80ft<sup>2</sup>. If building roof area >10,000 ft<sup>2</sup> then minimum area is 160ft<sup>2</sup>.
- E. Check "yes" if answers to questions in columns K through P are "yes".

<input checked="" type="checkbox"/> <b>Building Complies with Minimum Solar Zone Area Requirement</b>	Check box if Proposed Solar Zone Area [S] is equal to or greater than the Minimum Solar Zone Area [G]
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## §110.10 and the Field Inspector



- **Verify at Final**
  - Refer to NRCC-SRA for method of compliance
    - Solar zone (unobstructed)
    - Thermostats and high efficacy lighting (exception)
- **Verify if solar installed**
  - [NRCI-SPV](#) form
  - [NRCI-STH](#) form (H<sub>2</sub>O heating)

*\* Forms must be registered starting 1/1/15*

**SOLAR PHOTOVOLTAIC SYSTEM**

CEC-NRCI-SPV-01-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF INSTALLATION		NRCI-SPV-01-E
Solar Photovoltaic System		(Page 1 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Dwelling Address: <b>2013 CALBO Drive</b>	City <b>Sacramento</b>	Zip Code <b>95814</b>

*The installer is required to fill out this form for all newly installed Photovoltaic Systems (PV) when the PV system is being used to claim Exception 1 to Section 110.10(b)1B of the Solar Ready requirements. Section 110.10(b)1B applies to High-rise Multifamily Buildings and Hotel/Motel Occupancies with fewer than ten stories and nonresidential buildings with three stories or fewer. An installer wishing to claim Exception 1 to Section 110.10(b)1B for a Low-rise Multifamily building must submit a CF2R—SPV-01-E.*

A. General Information		
01	Total Roof Area (ft <sup>2</sup> )	<b>2,000 ft<sup>2</sup></b>
02.	Minimum Nameplate DC Power Rating (Watts) = Total Roof Area (ft <sup>2</sup> ) x (1 Watt/ft <sup>2</sup> )	<b>2,000 W</b>
03	Enter Module Manufacturer Name	<b>Solar Guys Manuf.</b>
04	Enter Module Model Number	<b>SP-0101-2013</b>
05	Enter Module Nameplate DC Power Rating measure under Standard Test Conditions (watts)	<b>1,000 W</b>
06	Enter Number of Modules used in the PV System	<b>2</b>
07	Installed PV System Nameplate DC Power Rating (Watts) = Module Nameplate DC Power Rating (watts) x Number of Modules used in PV System	<b>2,000 W</b>
08	If Installed PV System Nameplate DC Power Rating is greater than or equal to Minimum Nameplate DC Power Rating then the PV system complies, otherwise the PV System does not comply.	Complies <input checked="" type="checkbox"/> Does Not Comply <input type="checkbox"/>
The responsible person's signature on this document certifies that these requirements have been met.		



CERTIFICATE OF INSTALLATION		NRCI-STH-01-E
Solar Water Heating Systems		(Page 1 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

**A. SOLAR WATER HEATING SYSTEMS**

01	Manufacturer Name	
02	Model Number	
03	SRCC Certification Number	
04	Solar Savings Fraction (annual average value)	
05	# of Collectors in System	
06	Collector Size (Square Footage)	
07	Total Storage Volume (gallons)	
08	Solar System Collector Orientation	
09	Solar System Collector Tilt	

The responsible person's signature on this Certificate of Installation indicates the system identified on this Certificate has complied with all applicable requirements specified in this Table.

**B. SRCC OG-100 CERTIFIED COLLECTORS**

*The installed system shall meet the following eligibility criteria:*

01	System is installed at the same orientation as modeled.
02	System is installed at the same tilt as modeled.
03	The system shall have the same collectors, pumps, controls, storage tank and backup water heater fuel type as the rated condition.
04	The collectors are located in a position that is not shaded by adjacent buildings or trees.
05	Backup Storage tanks are insulated with either an internal R-12 (labeled on tank) or external R-16

The responsible person's signature on this Certificate of Installation indicates the system identified on this Certificate has complied with all applicable requirements specified in this Table.

**C. SIZING COMPLIANCE WITH MULTIFAMILY PRESCRIPTIVE REQUIREMENTS:**

01	For climate zones 1 through 9 only - the solar system has an annual solar savings fraction of 0.2
02	For climate zones 10 through 16 only – the solar system has an annual solar savings fraction of 0.35

The responsible person's signature on this Certificate of Installation indicates the system identified on this Certificate has complied with all applicable requirements specified in this Table.

**D. MANDATORY MEASURES FOR SOLAR WATER HEATING SYSTEMS**

01	For Multifamily, Hotel and Motels backup storage tanks for solar water-heating systems have R-12 external insulation or R-16 internal insulation where the internal insulation R-value indicated on the exterior of the tank. (§150.0(j)1B).
02	All domestic hot water piping (including solar) shall be insulated (§150(j)2A) or (§120.3).
03	Solar water-heating system and/or/collectors are certified by the Solar Rating and Certification Corporation. (§150.0(n)).

The responsible person's signature on this Certificate of Installation indicates the system identified on this Certificate has complied with all applicable requirements specified in this Table.



# MECH Acceptance Testing

## 2008 – §125

- Testing mandatory if equip. installed for:
  - Outdoor air ventilation
  - Air economizers
  - Demand controls vent.
  - Supply fan variable flow cont.
  - Thermal energy storage
- Identified as “MECH-A”

## 2013 – §120.5

- New tests added for:
  - Supply air temp. reset cont.
  - Water cooled chillers w/condenser reset controls
  - EMCS
- Identified as “NRCA-MCH”
- Must be performed by Certified Mechanical Acceptance Test Technician (CMATT)



# §120.5 and the Plans Examiner

- Still verify req. Acceptance Tests on NRCC-MCH-01
  - NRCA-MCH-16A (supply air reset)
  - NRCA-MCH-17A (chiller condenser reset)
  - NRCA-MCH-18A (ECMS)
- Form must be incorporated onto plans

STATE OF CALIFORNIA  
**MECHANICAL SYSTEMS**  
 CECC-NRCC-MCH-01-E (Revised 2013)  
 CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE  
 NRCC-MCH-01-E  
 Mechanical Systems  
 Project Name: 2013 CALBO Training Sample Date Prepared: 01/01/14  
 (Page 2 of 4)

**MECHANICAL HVAC ACCEPTANCE FORMS (check box for required forms)**

**Designer:**  
 This form is to be used by the designer and attached to the plans. Listed below are all the acceptance tests for HVAC systems. The designer is required to check the applicable boxes for all acceptance tests that apply and list all equipment that requires an acceptance test. All equipment of the same type that requires a test, list the equipment description and the number of systems.

**Installing Contractor:**  
 The contractor who installed the equipment is responsible to either conduct the acceptance test them self or have a qualified entity run the test for them. If more than one person has responsibility for the acceptance testing, each person shall sign and submit the Certificate of Acceptance applicable to the portion of the construction or installation for which they are responsible. The following tests require a

**Enforcement Agency:**  
 Plancheck - The NRCC-MCH-01-E form is not considered a completed form and is not to be accepted by the building department unless the correct boxes are checked.  
 Inspector - Before occupancy permit is granted all newly installed process systems must be tested to ensure proper operations.

Test Description	# of units	MCH-12A Fault Detection & Diagnostics for DX Units	MCH-13A Automatic Fault Detection & Diagnostics for Air & Zone	MCH-14A Distributed Energy Storage DX AC Systems	MCH-15A Thermal Energy Storage (TES) Systems	MCH-16A Supply Air Temperature Reset Controls	MCH-17A Condenser Water Reset Controls	MCH-18A ECMS
Reset Controls	5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chillers	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
ECMS	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance June 2013

\* Form must be registered starting 1/1/15

<b>CERTIFICATE OF COMPLIANCE</b>	<b>NRCC-MCH-01-E</b>
<b>Mechanical Systems</b>	(Page 2 of 4)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>

**MECHANICAL HVAC ACCEPTANCE FORMS (check box for required forms)**

**Designer:**  
*This form is to be used by the designer and attached to the plans. Listed below are all the acceptance tests for HVAC systems. The designer is required to check the applicable boxes for all acceptance tests that apply and list all equipment that requires an acceptance test. All equipment of the same type that requires a test, list the equipment description and the number of systems.*

**Installing Contractor:**  
 The contractor who installed the equipment is responsible to either conduct the acceptance test them self or have a qualified entity run the test for them. If more than one person has responsibility for the acceptance testing, each person shall sign and submit the Certificate of Acceptance applicable to the portion of the construction or installation for which they are responsible. The following tests require a

**Enforcement Agency:**  
*Plancheck – The NRCC-MCH-01-E form is not considered a completed form and is not to be accepted by the building department unless the correct boxes are checked.  
 Inspector - Before occupancy permit is granted all newly installed process systems must be tested to ensure proper operations.*

Test Description		MCH-12A	MCH-13A	MCH-14A	MCH-15A	MCH-16A	MCH-17A	MCH-18A
Equipment Requiring Testing or Verification	# of units	Fault Detection & Diagnostics for DX Units	Automatic Fault Detection & Diagnostics for Air & Zone	Distributed Energy Storage DX AC Systems	Thermal Energy Storage (TES) Systems	Supply Air Temperature Reset Controls	Condenser Water Reset Controls	ECMS
<b>Reset Controls</b>	<b>5</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Chillers</b>	<b>10</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>ECMS</b>	<b>2</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



## §120.5 and the Plans Examiner *cont.*

- **All HVAC units/controls and req. acceptance test must be verified on the **NRCC-MCH-01 form****
- **Frequently req. test include:**
  - Outdoor air ventilation (NRCA-MCH-02)
  - Single zone unitary A/C and HP controls (NRCA-MCH-03)
  - Duct leakage (NRCA-MCH-04)
  - Economizer controls (NRCA-MCH-05)
  - DCV (NRCA-MCH-06)



# §120.5 and the Field Inspector

STATE OF CALIFORNIA  
Supply Air Temperature Reset Controls Acceptance  
CERTIFICATE OF ACCEPTANCE NRCA-MCH-16-F (Page 1 of 2)

STATE OF CALIFORNIA  
CONDENSER WATER SUPPLY TEMPERATURE RESET CONTROLS ACCEPTANCE  
CERTIFICATE OF ACCEPTANCE NRCA-MCH-17-F

STATE OF CALIFORNIA  
ENERGY MANAGEMENT CONTROL SYSTEM ACCEPTANCE  
CERTIFICATE OF ACCEPTANCE NRCA-MCH-18-F (Page 1 of 1)

**Construction**

- Supporting document
  - As-built and/or D
  - 2013 Building En Temperature Res
  - Building Energy E
- Instrumentation to pe
  - Hand-held tempe
  - Hand-held relativ
- Installation Verification
  - Check if the cond building plans or
  - Check if condens available and doc
  - Check if all coolin operational, and
  - Check if cooling t documented in th
  - Check if the follo water, and leavin
- Document that all syst one of the following:
  - Sensors are calibr
  - Factory calibrated Calibration compl TAB calibration re I have performed 12 months) check complete, from system sens
- From the control syste
  - Outdoor air drybulb te
  - Entering condense w

CA Building Energy Efficiency

June 2013

- At Final, still verify req. Acceptance forms
  - Refer to NRCC-MCH-01 form
- Verify Acceptance testing is performed by CMATT when required
  - Identify signature in Declaration Statement
- Verify all Acceptance forms are registered starting 1/1/15



# Supply Air Temperature Reset Controls Acceptance

CEC-NRCA-MCH-16-F (Revised 06/13)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF ACCEPTANCE		NRCA-MCH-16-F
Supply Air Temperature Reset Controls Acceptance		(Page 1 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

<i>Note: Submit one Certificate of Acceptance for each system that must demonstrate compliance.</i>	Enforcement Agency Use: Checked by/Date
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<b>Intent:</b>	<b><i>Verify that the supply air temperature modulates to meet system temperature setpoint(s).</i></b>
----------------	--

<b>Construction Inspection</b>									
<p>1. Supporting documentation needed to perform test may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>a. As-built and/or Design Documents, including Mechanical Equipment Schedules and control schedules.</li> <li>b. 2013 Building Energy Efficiency Standards Nonresidential Compliance Manual (<i>NA7.5.15 Supply Air Temperature Reset Controls Acceptance At-A-Glance</i>).</li> <li>c. 2013 Building Energy Efficiency Standards Nonresidential Appendix (Section NA7).</li> </ul>									
<p>2. Instrumentation to perform test includes, but is not limited to:</p> <ul style="list-style-type: none"> <li>a. Hand-held temperature sensor                      Date of calibration: <u>01/01/14</u> (<i>must be within one year</i>)</li> </ul>									
<p>3. Installation:</p> <p>Check the appropriate box:</p> <p><input checked="" type="checkbox"/> The supply air temperature reset controls are installed per the requirements of the 2013 Building Energy Efficiency Standards section 140.4(f): Multi-zone systems shall include controls that automatically reset supply-air temperatures:</p> <ul style="list-style-type: none"> <li>(1) In response to representative building loads or to outdoor air temperature; and</li> <li>(2) By at least 25 percent of the difference between the design supply-air temperature and the design room air temperature.</li> </ul> <p><input checked="" type="checkbox"/> An exception is taken to this requirement (one of the following must be true; acceptance test is not needed):</p> <p>Zones served by space-conditioning systems in which at least 75 percent of the energy for reheating, or providing warm air in mixing systems, is provided from a site-recovered or site-solar energy source.</p> <p>Where supply-air temperature reset would increase overall building energy use.</p> <p>Zones in which specific humidity levels are required to satisfy exempt process loads. Computer rooms or spaces with only IT equipment are not exempt process loads.</p> <p>Zones with a peak supply air quantity of 300 cfm or less.</p> <p>The system has controls to prevent reheat, recool, and simultaneous cooling and heating.</p>									
<p>4. Document that all system air temperature sensors are factory or field calibrated or perform field check (check a or b):</p> <table border="1"> <tr> <td>a.</td> <td>Factory calibrated, or Field-calibrated by TAB technician, commissioning agent, or other.</td> </tr> <tr> <td></td> <td><input checked="" type="checkbox"/> Calibration complete, all sensors within 2% of calibrated reference sensor (provide supporting documentation, e.g. a copy of TAB calibration results).</td> </tr> <tr> <td>b.</td> <td>I have performed a field check using a calibrated temperature standard (i.e. device that has been calibrated within the last 12 months).</td> </tr> <tr> <td></td> <td><input type="checkbox"/> Check complete, all air temperature sensors within 2% of calibrated reference sensor (provide supporting documentation, including results from system air sensors and calibrated reference standard).</td> </tr> </table>		a.	Factory calibrated, or Field-calibrated by TAB technician, commissioning agent, or other.		<input checked="" type="checkbox"/> Calibration complete, all sensors within 2% of calibrated reference sensor (provide supporting documentation, e.g. a copy of TAB calibration results).	b.	I have performed a field check using a calibrated temperature standard (i.e. device that has been calibrated within the last 12 months).		<input type="checkbox"/> Check complete, all air temperature sensors within 2% of calibrated reference sensor (provide supporting documentation, including results from system air sensors and calibrated reference standard).
a.	Factory calibrated, or Field-calibrated by TAB technician, commissioning agent, or other.								
	<input checked="" type="checkbox"/> Calibration complete, all sensors within 2% of calibrated reference sensor (provide supporting documentation, e.g. a copy of TAB calibration results).								
b.	I have performed a field check using a calibrated temperature standard (i.e. device that has been calibrated within the last 12 months).								
	<input type="checkbox"/> Check complete, all air temperature sensors within 2% of calibrated reference sensor (provide supporting documentation, including results from system air sensors and calibrated reference standard).								
<p>5. Document current supply air temperature: <u>75</u> °F</p>									
<b>Notes:</b>									



# Supply Air Temperature Reset Controls Acceptance

CEC-NRCA-MCH-16-F (Revised 06/13)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF ACCEPTANCE		NRCA-MCH-16-F
Supply Air Temperature Reset Controls Acceptance		(Page 2 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>


**A. Functional Testing**

Check to make sure that chilled / hot water coils, if used, are not already fully open and calling for maximum cooling / heating. If this is the case, reverse Steps 1 and 2 and/or change the set point range as necessary to conduct this test.

Reset control parameter is (circle one): **Outside air temperature, Zone or return air temperature, Zones calling for heating or cooling, or Other \_\_\_\_\_.**

**Step 1: During occupied mode, adjust the reset control parameter to decrease the supply air temperature (to the lower supply temperature limit).**

a. Supply air temperature controls modulate as intended.	<input checked="" type="radio"/> Y <input type="radio"/> N
b. Actual supply air temperature decreases to meet the new set point within +/- 2°F.	<input checked="" type="radio"/> Y <input type="radio"/> N
c. Supply air temperature stabilizes within 15 minutes.	<input checked="" type="radio"/> Y <input type="radio"/> N

Supply air temperature set point: 80 °F      Actual supply air temperature: 82 °F

**Step 2: During occupied mode, adjust the reset control parameter to increase the supply air temperature (to the upper supply temperature limit).**

a. Supply air temperature controls modulate as intended.	<input checked="" type="radio"/> Y <input type="radio"/> N
b. Actual supply air temperature increases to meet the new set point within +/- 2°F.	<input checked="" type="radio"/> Y <input type="radio"/> N
c. Supply air temperature stabilizes within 15 minutes.	<input checked="" type="radio"/> Y <input type="radio"/> N

Supply air temperature set point: 75 °F      Actual supply air temperature: 73 °F

**Step 3: Restore reset control parameter to automatic control.**

a. Supply air temperature controls modulate as intended.	<input checked="" type="radio"/> Y <input type="radio"/> N
b. Actual supply air temperature changes to meet the new set point within +/- 2°F.	<input checked="" type="radio"/> Y <input type="radio"/> N
c. Supply air temperature stabilizes within 15 minutes.	<input checked="" type="radio"/> Y <input type="radio"/> N

Supply air temperature set point: 78 °F      Actual supply air temperature: 76 °F

**B. Evaluation :**

**PASS: All Construction Inspection responses are complete and Functional Testing Results are all circled YES.**

Notes:


**CONDENSER WATER SUPPLY TEMPERATURE RESET CONTROLS ACCEPTANCE**

CERTIFICATE OF ACCEPTANCE		NRCA-MCH-17-F
Condenser Water Supply Temperature Reset Controls Acceptance		(Page 1 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

<i>Note: Submit one Certificate of Acceptance for each system that must demonstrate compliance.</i>	Enforcement Agency Use: Checked by/Date
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<b>Intent:</b>	<b>Ensure that the condenser water supply temperature is automatically reset as indicated in the control sequence(s).</b>
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<b>Construction Inspection</b>					
<b>1.</b> Supporting documentation needed to perform test may include, but is not limited to: <ul style="list-style-type: none"> <li>a. As-built and/or Design Documents, including Mechanical Equipment Schedules and control schedules.</li> <li>b. 2013 Building Energy Efficiency Standards Nonresidential Compliance Manual (<i>NA7.5.65 Condenser Water Supply Temperature Reset Controls Acceptance At-A-Glance</i>).</li> <li>c. Building Energy Efficiency Standards Nonresidential Appendix (Section NA7).</li> </ul>					
<b>2.</b> Instrumentation to perform test includes, but is not limited to: <ul style="list-style-type: none"> <li>a. Hand-held temperature sensor _____ Date of calibration (must be within 1 year)</li> <li>b. Hand-held relative humidity or wet-bulb temperature sensor / psychrometer _____ Date of calibration (must be within 1 year)</li> </ul>					
<b>3.</b> Installation Verification: <ul style="list-style-type: none"> <li><input type="checkbox"/> Check if the condenser water supply system and control system are installed per the system design, as documented on the building plans or as-builts.</li> <li><input type="checkbox"/> Check if condenser water supply temperature control sequence, including condenser water supply high and low limits, are available and documented in the building documents.</li> <li><input type="checkbox"/> Check if all cooling tower fan motors are operational, and cooling tower fan speed controls (e.g. VSDs) are installed, operational, and connected to cooling tower fan motors per OEM start-up manuals and sequence of operation.</li> <li><input type="checkbox"/> Check if cooling tower fan control sequence, including tower design wetbulb temperature and approach, are available and documented in the building documents.</li> <li><input type="checkbox"/> Check if the following temperature sensors are installed per plans: outdoor air drybulb and wetbulb, entering condenser water, and leaving chilled water. Note any discrepancies:</li> </ul>					
<b>4.</b> Document that all system temperature and relative humidity sensors are factory or field calibrated or perform field check (check one of the following): <ul style="list-style-type: none"> <li><input type="checkbox"/> Sensors are calibrated by others.             <ul style="list-style-type: none"> <li><input type="checkbox"/> Factory calibrated, or Field-calibrated by TAB technician, commissioning agent, or other. Calibration complete, all sensors within 2% of calibrated reference sensor (provide supporting documentation, i.e. a copy of TAB calibration results).</li> <li><input type="checkbox"/> I have performed a field check using a calibrated temperature standard (i.e. device that has been calibrated within the last 12 months). Check complete, all sensors within 2% of calibrated reference sensor (provide supporting documentation, including results from system sensors and calibrated reference standard).</li> </ul> </li> </ul>					
<b>5.</b> From the control system, or using temperature sensors, document the following: <table border="1" style="width:100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 50%;">Outdoor air drybulb temperature _____ ° F</td> <td style="width: 50%;">Outdoor air wetbulb temperature _____ ° F</td> </tr> <tr> <td>Entering condenser water temperature _____ ° F</td> <td>Leaving chilled water temperature _____ ° F</td> </tr> </table>		Outdoor air drybulb temperature _____ ° F	Outdoor air wetbulb temperature _____ ° F	Entering condenser water temperature _____ ° F	Leaving chilled water temperature _____ ° F
Outdoor air drybulb temperature _____ ° F	Outdoor air wetbulb temperature _____ ° F				
Entering condenser water temperature _____ ° F	Leaving chilled water temperature _____ ° F				



CERTIFICATE OF ACCEPTANCE		NRCA-MCH-17-F
Condenser Water Supply Temperature Reset Controls Acceptance		(Page 2 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

**A. Functional Testing**

The system cooling load must be sufficiently high to run the test. If necessary, artificially increase the cooling / evaporator load to perform the functional tests. If necessary, reverse Steps 1 & 2 in the test based on atmospheric conditions and building loads.

EXEMPTION: If the control sequence differs significantly from that implied by the tests, and / or has already been tested during the building commissioning process, attach a description of the control sequence, a description of the tests that were done to verify the system operates according to the sequence, the test results, and a plot of any associated trend data.

Reset control parameter is (circle one): Outside air wet-bulb temperature, Load signal from chiller, Condenser water & chilled water temperatures, or Other \_\_\_\_\_.

**Step 1: Adjust the reset control parameter to decrease the condenser water temperature (toward the lower supply temperature limit).**

a. Condenser water temperature controls modulate as intended.	Y / N
b. Actual condenser water supply temperature decreases to meet new set point within + / - 2°F.	Y / N
c. Cooling tower fan(s) stage properly and/or adjust speed accordingly to meet lower set point.	Y / N
d. Chiller load amps decrease.	Y / N

**Step 2: Adjust the reset control parameter to increase the condenser water temperature (toward the upper supply temperature limit).**

a. Condenser water temperature controls modulate as intended.	Y / N
b. Actual condenser water supply temperature increases to meet new set point within + / - 2°F.	Y / N
c. Cooling tower fan(s) stage properly and/or adjust speed accordingly to meet upper set point.	Y / N
d. Chiller load amps increase.	Y / N

**Step 3: Restore reset control parameter to automatic control.**

a. Condenser water temperature controls modulate as intended.	Y / N
b. Actual condenser water supply temperature changes to meet new set point within + / - 2°F.	Y / N
c. Cooling tower fan(s) stage properly and/or adjust speed accordingly to meet set point.	Y / N

**B. Evaluation:**

**PASS:** All **Construction Inspection** responses are complete and **Functional Testing Results** are all circled **YES**.

**Notes:**




CERTIFICATE OF ACCEPTANCE		NRCA-MCH-18-F
Energy Management Control System Acceptance		(Page 1 of 1)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

<b>Note: Submit one Certificate of Acceptance for each system that must demonstrate compliance.</b>	<i>Enforcement Agency Use: Checked by/Date:</i>
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<b>Intent:</b>	<i>The purpose of this acceptance test is to help ensure the central control system, when installed, is properly installed and configured and capable of meeting the applicable requirements of Title 24 Part 6. The EMCS is a complex, highly customized control system with many opportunities for installation and programming problems. Obviously it is important to identify, diagnose, and resolve these problems. This acceptance test can help assist with this effort.</i>
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<b>A. Construction Inspection</b>
<p>Prior to functional testing and conducting other acceptance tests that rely on the EMCS:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Factory start-up and check-out completed</li> <li><input type="checkbox"/> Point-to-point verification completed</li> <li><input type="checkbox"/> I/O point lists available</li> <li><input type="checkbox"/> Sequence of operations of each system are programmed</li> <li><input type="checkbox"/> Written sequences are available</li> <li><input type="checkbox"/> Input sensors are calibrated</li> </ul>

<b>B. Functional Testing</b>	<b>Results</b>
Conduct the following verification checks to validate the functionality of the EMCS:	
1. Verify the control graphics represent the system configuration	Y / N
2. Verify control points are properly mapped to the graphics screen	Y / N
3. Raise and lower a sampling of space temperature setpoints in the software and verify the system responds appropriately	Y / N
4. Verify the time-of-day start-up and shut-down function initiates a proper system response	Y / N
5. Verify trending capabilities by establishing trend logs for a sampling of control points	Y / N
6. Verify alarm conditions are monitored	Y / N
7. Verify the EMCS panel is installed on an emergency power circuit or has adequate battery back-up	Y / N

<b>C. Testing Results</b>	<b>PASS / FAIL</b>	
Test passes if all <b>Construction Inspection</b> boxes are checked and all <b>Functional Testing</b> results are 'Y'	?	?



## §120.5 and the Field Inspector *cont.*

- **Occupancy permit shall not be issued until all req. Acceptance tests/forms are verified**
  - Refer to **NRCC-MCH-01 form**
- **When ATTCPs are interim approved, CMATT will be req. for only 8 tests**
  - Listed in [§10-103-B](#)
- **CMATT testing will be req. for ALL acceptance tests once ATTCPs are fully approved**
  - Check website for approved ATTCPs



# Covered Processes

## 2008 – §126

- Requirements for refrigerated warehouses  $\geq$  3,000 ft<sup>2</sup>:
  - Insulation (walls, roof, etc.)
  - Evaporators
  - Condensers
  - Compressors

## 2013 – §120.6

- Refrigerated warehouse reqs. updated
  - Acceptance testing req.
- Covered processes added:
  - Commercial refrigeration
  - Enclosed parking garages
  - Process boilers
  - Compressed air systems



## Covered Processes *cont.*

- **Commercial refrigeration reqs. in [§120.6\(b\)](#)**
  - Applicable to retail food stores with CFA  $\geq 8,000$  ft<sup>2</sup> that have refrigeration
- **Enclosed parking garages reqs. in [§120.6\(c\)](#)**
  - Applicable if total design exhaust rate  $\geq 10,000$  CFM
  - Acceptance testing req. for ventilation
- **Process boiler reqs. in [§120.6\(d\)](#)**
  - Applicability based on boiler capacity (Btu/h)
- **Compressed air system reqs. in [§120.6\(e\)](#)**
  - Applicable to compressors with HP  $\geq 25$
  - Acceptance testing req. for compressor and controls

an approved Acceptance Test Technician Certification Provider. The CMATT shall complete all Certificate of Acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

**NOTE:** Authority cited: Sections 25402, 25402.1, and 25213, Public Resources Code. Reference: Sections 25007, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8 and 25910, Public Resources Code.

## SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

### (a) Mandatory Requirements for Refrigerated Warehouses

Refrigerated Warehouses that are greater than or equal to 3,000 square feet shall meet the requirements of Subsections 1, 2, 3, 6 and 7 of Section 120.6(a).

Refrigerated Spaces that are less than 3,000 square feet shall meet the requirements of the Appliance Efficiency Regulations for walk-in coolers or freezers contained in the Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 through 1608).

Refrigerated Spaces that (i) comprise a total of 3,000 square feet or more; and (ii) are collectively served by the same refrigeration system compressor(s) and condenser(s) shall meet the requirements of Subsections 4, 5 and 7 of Section 120.6(a).

- Insulation Requirements.** Exterior surfaces of refrigerated warehouses shall be insulated at least to the R-values in TABLE 120.6-A.

TABLE 120.6-A REFRIGERATED WAREHOUSE INSULATION

SPACE	SURFACE	MINIMUM R-VALUE (°F·hr·sf/Btu)
Freezers	Roof/Ceiling	R-40
	Wall	R-36
	Floor	R-35
	Floor with all heating from productive refrigeration capacity <sup>1</sup>	R-20
Coolers	Roof/Ceiling	R-28
	Wall	R-28

<sup>1</sup> All underslab heating is provided by a heat exchanger that provides refrigerant subcooling or other means that result in productive refrigeration capacity on the associated refrigerated system.

- Underslab heating.** Electric resistance heat shall not be used for the purposes of underslab heating.

**EXCEPTION to Section 120.6(a)2:** Underslab heating systems controlled such that the electric resistance heat is thermostatically controlled and disabled during the summer on-peak period defined by the local electric utility.

- Evaporators.** New fan-powered evaporators used in coolers and freezers shall conform to the following:

A. Single phase fan motors less than 1 hp and less than 460 Volts in newly installed evaporators shall be electronically commutated motors or shall have a minimum motor efficiency of 70 percent when rated in accordance with NEMA Standard MG 1-2006 at full load rating conditions.

B. Evaporator fans served either by a suction group with multiple compressors, or by a single compressor with variable capacity capability shall be variable speed and the speed shall be controlled in response to space temperature or humidity.

**EXCEPTION 1 to Section 120.6(a)3B:** Addition, alteration or replacement of less than all of the evaporators in an existing refrigerated space that does not have speed-controlled evaporators.

**EXCEPTION 2 to Section 120.6(a)3B:** Coolers within refrigerated warehouses that maintain a Controlled Atmosphere for which a licensed engineer has certified that the types of products stored will require constant operation at 100 percent of the design airflow.

**EXCEPTION 3 to Section 120.6(a)3B:** Areas within refrigerated warehouses that are designed solely for the purpose of quick chilling/freezing of products (space with design cooling capacities of greater than 240 Btu/hr-ft<sup>2</sup> (2 tons per 100 ft<sup>2</sup>)).

- C. Evaporator fans served by a single compressor that does not have variable capacity shall utilize controls to reduce airflow by at least 40 percent for at least 75 percent of the time when the compressor is not running.

**EXCEPTION to Section 120.6(a)3C:** Areas within refrigerated warehouses that are designed solely for the purpose of quick chilling/freezing of products (space with design cooling capacities of greater than 240 Btu/hr-ft<sup>2</sup> (2 tons per 100 ft<sup>2</sup>)).

4. **Condensers.** New fan-powered condensers on new refrigeration systems shall conform to the following:

- A. Design saturated condensing temperatures for evaporative-cooled condensers and water-cooled condensers served by fluid coolers or cooling towers shall be less than or equal to:
- i. The design wetbulb temperature plus 20°F in locations where the design wetbulb temperature is less than or equal to 76°F; or
  - ii. The design wetbulb temperature plus 19°F in locations where the design wetbulb temperature is between 76°F and 78°F; or
  - iii. The design wetbulb temperature plus 18°F in locations where the design wetbulb temperature is greater than or equal to 78°F.

**EXCEPTION to Section 120.6(a)4A:** Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling or freezing, or process refrigeration cooling for other than a refrigerated space.

- B. Design saturated condensing temperatures for air-cooled condensers shall be less than or equal to the design drybulb temperature plus 10°F for systems serving freezers and shall be less than or equal to the design drybulb temperature plus 15°F for systems serving coolers.

**EXCEPTION 1 to Section 120.6(a)4B:** Condensing units with a total compressor horsepower less than 100 HP.

**EXCEPTION 2 to Section 120.6(a)4B:** Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling or freezing, or process refrigeration cooling for other than a refrigerated space.

- C. All condenser fans for evaporative-cooled condensers or fans on cooling towers or fluid coolers shall be continuously variable speed, and the condensing temperature control system shall control the speed of all fans serving a common condenser high side in unison. The minimum condensing temperature setpoint shall be less than or equal to 70°F.
- D. All condenser fans for air-cooled condensers shall be continuously variable speed and the condensing temperature or pressure control system shall control the speed of all condenser fans serving a common condenser high side in unison. The minimum condensing temperature setpoint shall be less than or equal to 70°F.
- E. Condensing temperature reset. The condensing temperature set point of systems served by air-cooled condensers shall be reset in response to ambient drybulb temperature. The condensing temperature set point of systems served by evaporative-cooled condensers or water-cooled condensers (via cooling towers or fluid coolers) shall be reset in response to ambient wetbulb temperatures.

**EXCEPTION to Section 120.6(a)4E:** Condensing temperature control strategies approved by the Executive Director that have been demonstrated to provide at least equal energy savings.

- F. Fan-powered condensers shall meet the condenser efficiency requirements listed in TABLE 120.6-B. Condenser efficiency is defined as the Total Heat of Rejection (THR) capacity divided by all electrical input power including fan power at 100 percent fan speed, and power of spray pumps for evaporative condensers.
- G. Air-cooled condensers shall have a fin density no greater than 10 fins per inch.

**EXCEPTION to Section 120.6(a)4G:** Micro-channel condensers.

**TABLE 120.6-B FAN-POWERED CONDENSERS – MINIMUM EFFICIENCY REQUIREMENTS**

CONDENSER TYPE	REFRIGERANT TYPE	MINIMUM EFFICIENCY	RATING CONDITION
Outdoor Evaporative-Cooled with THR Capacity > 8,000 MBH	All	350 Btuh/Watt	100°F Saturated Condensing Temperature (SCT), 70°F Outdoor Wetbulb Temperature
Outdoor Evaporative-Cooled with THR Capacity < 8,000 MBH and Indoor Evaporative-Cooled	All	160 Btuh/Watt	
Outdoor Air-Cooled	Ammonia	75 Btuh/Watt	105°F Saturated Condensing Temperature (SCT), 95°F Outdoor Drybulb Temperature
	Halocarbon	65 Btuh/Watt	
Indoor Air-Cooled	All	Exempt	

- 5. **Compressors.** Compressor systems utilized in refrigerated warehouses shall conform to the following:
  - A. Compressors shall be designed to operate at a minimum condensing temperature of 70°F or less.
  - B. New open-drive screw compressors in new refrigeration systems with a design saturated suction temperature (SST) of 28°F or lower that discharges to the system condenser pressure shall control compressor speed in response to the refrigeration load.

**EXCEPTION 1 to Section 120.6(a)5B:** Refrigeration plants with more than one dedicated compressor per suction group.

**EXCEPTION 2 to Section 120.6(a)5B:** Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling or freezing, or process refrigeration cooling for other than a refrigerated space.

- C. New screw compressors with nominal electric motor power greater than 150 HP shall include the ability to automatically vary the compressor volume ratio (Vi) in response to operating pressures.
- 6. **Infiltration Barriers.** Passageways between freezers and higher-temperature spaces, and passageways between coolers and non-refrigerated spaces, shall have an infiltration barrier consisting of strip curtains, an automatically-closing door, or an air curtain designed by the manufacturer for use in the passageway and temperature for which it is applied.

**EXCEPTION 1 to Section 120.6(a)6:** Openings with less than 16 ft<sup>2</sup> of opening area.

**EXCEPTION 2 to Section 120.6(a)6:** Dock doorways for trailers.

- 7. **Refrigeration System Acceptance.** Before an occupancy permit is granted for a new refrigerated warehouse, or before a new refrigeration system serving a refrigerated warehouse is operated for normal use, the following equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements:
  - A. Electric resistance underslab heating systems shall be tested in accordance with NA7.10.1.
  - B. Evaporators fan motor controls shall be tested in accordance with NA7.10.2.
  - C. Evaporative condensers shall be tested in accordance with NA7.10.3.1.

- D. Air-cooled condensers shall be tested in accordance with NA7.10.3.2.
- E. Variable speed compressors shall be tested in accordance with NA7.10.4.

**(b) Mandatory Requirements for Commercial Refrigeration**

Retail food stores with 8,000 square feet or more of conditioned area, and that utilize either: refrigerated display cases, or - walk-in coolers or freezers connected to remote compressor units or condensing units, shall meet the requirements of Subsections 1 through 4.

**1. Condensers serving refrigeration systems.** Fan-powered condensers shall conform to the following requirements:

- A. All condenser fans for air-cooled condensers, evaporative-cooled condensers, air or water-cooled fluid coolers or cooling towers shall be continuously variable speed, with the speed of all fans serving a common condenser high side controlled in unison.
- B. The refrigeration system condenser controls for systems with air-cooled condensers shall use variable-setpoint control logic to reset the condensing temperature setpoint in response to ambient drybulb temperature.
- C. The refrigeration system condenser controls for systems with evaporative-cooled condensers shall use variable-setpoint control logic to reset the condensing temperature setpoint in response to ambient wetbulb temperature.

**EXCEPTION to Section 120.6(b)1B and C:** Condensing temperature control strategies approved by the Executive Director that have been demonstrated to provide equal energy savings.

- D. The minimum condensing temperature setpoint shall be less than or equal to 70°F.
- E. Fan-powered condensers shall meet the specific efficiency requirements listed in Table 120.6-C.

**TABLE 120.6-C FAN-POWERED CONDENSERS –SPECIFIC EFFICIENCY REQUIREMENTS**

CONDENSER TYPE	MINIMUM SPECIFIC-EFFICIENCY <sup>a</sup>	RATING CONDITION
Evaporative-Cooled	160 Btuh/W	100°F Saturated Condensing Temperature (SCT), 70°F Entering Wetbulb Temperature
Air-Cooled	65 Btuh/W	105°F Saturated Condensing Temperature (SCT), 95°F Entering Drybulb Temperature

<sup>a</sup> See Section 100.1 for definition of condenser specific efficiency.

**EXCEPTION 1 to Section 120.6(b)1E:** Condensers with a Total Heat Rejection capacity of less than 150,000 Btuh at the specific efficiency rating condition.

**EXCEPTION 2 to Section 120.6(b)1E:** Stores located in Climate Zone 1.

**EXCEPTION 3 to Section 120.6(b)1E:** Existing condensers that are reused for an addition or alteration.

- F. Air-cooled condensers shall have a fin density no greater than 10 fins per inch.

**EXCEPTION 1 to Section 120.6(b)1F:** Micro-channel condensers.

**EXCEPTION 2 to Section 120.6(b)1F:** Existing condensers that are reused for an addition or alteration.

**EXCEPTION to Section 120.6(b)1:** New condensers replacing existing condensers when the attached compressor system Total Heat of Rejection does not increase and less than 25 percent of both the attached compressors and the attached display cases are new.

**2. Compressor Systems.** Refrigeration compressor systems and condensing units shall conform to the following requirements.

- A. Compressors and multiple-compressor suction groups shall include control systems that use floating suction pressure logic to reset the target saturated suction temperature based on the temperature requirements of the attached refrigeration display cases or walk-ins.

**EXCEPTION 1 to Section 120.6(b)2A:** Single compressor systems that do not have continuously variable capacity capability.

**EXCEPTION 2 to Section 120.6(b)2A:** Suction groups that have a design saturated suction temperature of 30°F or higher, or suction groups that comprise the high stage of a two-stage or cascade system or that primarily serve chillers for secondary cooling fluids.

- B. Liquid subcooling shall be provided for all low temperature compressor systems with a design cooling capacity equal or greater than 100,000 Btu/hr with a design saturated suction temperature of -10°F or lower, with the subcooled liquid temperature maintained continuously at 50°F or less at the exit of the subcooler, using compressor economizer port(s) or a separate medium or high temperature suction group operating at a saturated suction temperature of 18°F or higher.

**EXCEPTION to Section 120.6(b)2B:** Low temperature cascade systems that condense into another refrigeration system rather than condensing to ambient temperature.

**EXCEPTION to Section 120.6(b)2:** Existing compressor systems that are reused for an addition or alteration.

**3. Refrigerated Display Cases.** Lighting in refrigerated display cases, and lights on glass doors installed on walk-in coolers and freezers shall be controlled by one of the following:

- A. Automatic time switch controls to turn off lights during non-business hours. Timed overrides for any line-up or walk-in case may only be used to turn the lights on for up to one hour. Manual overrides shall time-out automatically to turn the lights off after one hour.
- B. Motion sensor controls on each case that reduce display case lighting power by at least 50 percent within 30 minutes after the area near the case is vacated.

**EXCEPTION to Section 120.6(b)3:** Stores which are normally open for business 140 hours or more per week.

**4. Refrigeration Heat Recovery.**

- A. HVAC systems shall utilize heat recovery from refrigeration system(s) for space heating, using no less than 25 percent of the sum of the design Total Heat of Rejection of all refrigeration systems that have individual Total Heat of Rejection values of 150,000 Btu/h or greater at design conditions.

**EXCEPTION 1 to Section 120.6(b)4A:** Stores located in Climate Zone 15.

**EXCEPTION 2 to Section 120.6(b)4A:** HVAC systems or refrigeration systems that are reused for an addition or alteration.

- B. The increase in hydrofluorocarbon refrigerant charge associated with refrigeration heat recovery equipment and piping shall be no greater than 0.35 lbs per 1,000 Btu/h of heat recovery heating capacity.

**(c) Mandatory Requirements for Enclosed Parking Garages.** Mechanical ventilation systems for enclosed parking garages where the total design exhaust rate for the garage is greater than or equal to 10,000 cfm shall conform to all of the following:

1. Automatically detect contaminant levels and stage fans or modulate fan airflow rates to 50 percent or less of design capacity provided acceptable contaminant levels are maintained.
2. Have controls and/or devices that will result in fan motor demand of no more than 30 percent of design wattage at 50 percent of design airflow.
3. CO shall be monitored with at least one sensor per 5,000 ft<sup>2</sup>, with the sensor located in the highest expected concentration locations, with at least two sensors per proximity zone. A proximity zone is defined as an area that is isolated from other areas either by floor or other impenetrable obstruction.
4. CO concentration at all sensors is maintained at 25 ppm or less at all times.
5. The ventilation rate shall be at least 0.15 cfm/ft<sup>2</sup> when the garage is scheduled to be occupied.

6. The system shall maintain the garage at negative or neutral pressure relative to other occupiable spaces when the garage is scheduled to be occupied.
7. CO sensors shall be:
  - A. Certified by the manufacturer to be accurate within plus or minus 5 percent of measurement.
  - B. Factory calibrated.
  - C. Certified by the manufacturer to drift no more than 5 percent per year.
  - D. Certified by the manufacturer to require calibration no more frequently than once a year.
  - E. Monitored by a control system. The system shall have logic that automatically checks for sensor failure by the following means. Upon detection of a failure, the system shall reset to design ventilation rates and transmit an alarm to the facility operators.
    - i. If any sensor has not been calibrated according to the manufacturer's recommendations within the specified calibration period, the sensor has failed.
    - ii. During unoccupied periods the system compares the readings of all sensors, e.g. if any sensor is more than 15 ppm above or below the average of all sensors for longer than 4 hours, the sensor has failed.
    - iii. During occupied periods the system compares the readings of sensors in the same proximity zone, e.g. if the 30 minute rolling average for any sensor in a proximity zone is more than 15 ppm above or below the 30 minute rolling average for other sensor(s) in that proximity zone, the sensor has failed.

**8. Parking Garage Ventilation System Acceptance.** Before an occupancy permit is granted for a parking garage system subject to Section 120.6(c), the following equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.12.

**EXCEPTION 1 to Section 120.6(c):** Any garage, or portion of a garage, where more than 20 percent of the vehicles expected to be stored have non gasoline combustion engines.

**EXCEPTION 2 to Section 120.6(c):** Additions and alterations to existing garages where less than 10,000 cfm of new exhaust capacity is being added.

**(d) Mandatory Requirements for Process Boilers**

1. Combustion air positive shut-off shall be provided on all newly installed process boilers as follows:
  - A. All process boilers with an input capacity of 2.5 MMBtu/h (2,500,000 Btu/h) and above, in which the boiler is designed to operate with a non-positive vent static pressure.
  - B. All process boilers where one stack serves two or more boilers with a total combined input capacity per stack of 2.5 MMBtu/h (2,500,000 Btu/h).
2. Process boiler combustion air fans with motors 10 horsepower or larger shall meet one of the following for newly installed boilers:
  - A. The fan motor shall be driven by a variable speed drive; or
  - B. The fan motor shall include controls that limit the fan motor demand to no more than 30 percent of the total design wattage at 50 percent of design air volume.
3. Newly installed process boilers with an input capacity of 5 MMBtu/h (5,000,000 Btu/h) to 10 MMBtu/h (10,000,000 Btu/h) shall maintain excess (stack-gas) oxygen concentrations at less than or equal to 5.0 percent by volume on a dry basis over firing rates of 20 percent to 100 percent. Combustion air volume shall be controlled with respect to firing rate or measured flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited.
4. Newly installed process boilers with an input capacity greater than 10 MMBtu/h (10,000,000 Btu/h) shall maintain excess (stack-gas) oxygen concentrations at less than or equal to 3.0 percent by volume on a dry basis over firing rates of 20 percent to 100 percent. Combustion air volume shall be controlled with respect to

measured flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited.

- (e) **Mandatory Requirements for Compressed Air Systems.** All new compressed air systems, and all additions or alterations of compressed air systems where the total combined online horsepower (hp) of the compressor(s) is 25 horsepower or more shall meet the requirements of Subsections 1 through 3. These requirements apply to the compressors and related controls that provide compressed air and do not apply to any equipment or controls that use or process the compressed air.

**EXCEPTION to Section 120.6(e):** Alterations of existing compressed air systems that include one or more centrifugal compressors.

**1. Trim Compressor and Storage.** The compressed air system shall be equipped with an appropriately sized trim compressor and primary storage to provide acceptable performance across the range of the system and to avoid control gaps. The compressed air system shall comply with Subsection A or B below:

- A. The compressed air system shall include one or more variable speed drive (VSD) compressors. For systems with more than one compressor, the total combined capacity of the VSD compressor(s) acting as trim compressors must be at least 1.25 times the largest net capacity increment between combinations of compressors. The compressed air system shall include primary storage of at least one gallon per actual cubic feet per minute (acfm) of the largest trim compressor; or,
- B. The compressed air system shall include a compressor or set of compressors with total effective trim capacity at least the size of the largest net capacity increment between combinations of compressors, or the size of the smallest compressor, whichever is larger. The total effective trim capacity of single compressor systems shall cover at least the range from 70 percent to 100 percent of rated capacity. The effective trim capacity of a compressor is the size of the continuous operational range where the specific power of the compressor (kW/100 acfm) is within 15 percent of the specific power at its most efficient operating point. The total effective trim capacity of the system is the sum of the effective trim capacity of the trim compressors. The system shall include primary storage of at least 2 gallons per acfm of the largest trim compressor.

**EXCEPTION 1 to Section 120.6(e)1:** Compressed air systems in existing facilities that are adding or replacing less than 50 percent of the online capacity of the system.

**EXCEPTION 2 to Section 120.6(e)1:** Compressed air systems that have been approved by the Energy Commission Executive Director as having demonstrated that the system serves loads for which typical air demand fluctuates less than 10 percent.

**2. Controls.** Compressed air systems with more than one compressor online, having a combined horsepower rating of more than 100 hp, must operate with a controller that is able to choose the most energy efficient combination of compressors within the system based on the current air demand as measured by a sensor.

**3. Compressed Air System Acceptance.** Before an occupancy permit is granted for a compressed air system subject to Section 120.6(e), the following equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA 7.13.



# §120.6 and the Plans Examiner

**STATE OF CALIFORNIA**  
**GARAGE EXHAUST**  
CERTIFICATE OF COMPLIANCE  
NRCC-PRC-02-E  
(Page 1 of 1)

Design Exhaust Airflow (SCM) **10,000 CFM**

**STATE OF CALIFORNIA**  
**PROCESS BOILER REQUIREMENTS**  
CERTIFICATE OF COMPLIANCE  
NRCC-PRC-11-E  
(Page 1 of 1)

Equipment Tags and System Description <sup>1</sup>					
Boiler Input Capacity (MMBtu/h) <sup>2</sup>			<b>2.5</b> MMbtu/h		
<b>MANDATORY MEASURES</b>	<b>F-24 Sirens</b>	<b>Reference to the Requirements in the Contract Documents<sup>3</sup></b>			
Combustion Air Sillcut <sup>4</sup>	120.6 (B)1A & B		<b>M 1 (Note Block)</b>		
Combustion Fan Speed Control	120.6 (B)2		<b>Variable Speed</b>		
Excess Oxygen	120.6 (E)5B.4		<b>N/A</b>		

- **Verify applicable Certificate of Compliance on plans**
  - NRCC-PRC-02 (Garages)
  - NRCC-PRC-05 ([Comm. Refrig.](#))
  - NRCC-PRC-10 ([Comp. Air Sys.](#))
  - NRCC-PRC-11 (Boilers)
- **Verify specifications match the plans (mechanical schedules, note blocks, etc.)**

*\* Forms must be registered starting 1/1/15*

CERTIFICATE OF COMPLIANCE		NRCC-PRC-02-E
Garage Exhaust		(Page 1 of 1)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>	

DESIGN EXHAUST AIRFLOW (CFM) <sup>1</sup> : <b>10,000 CFM</b>	EXCEPTIONS <sup>2</sup> :	
<b>Equipment Tags and System Description<sup>3</sup></b>		
<b>MANDATORY MEASURES</b>	<b>T-24 Sections</b>	<b>Reference to the Requirements in the Contract Documents<sup>4</sup></b>
Exhaust Fan Control	120.6 (c)1 & 2	<b>M.2 (Fan Schedule)</b>
CO Sensor Location	120.6 (c)3	<b>M.3 (CO Note Block)</b>
CO Sensor Setpoint	120.6 (c)4	<b>M.3 (CO Note Block)</b>
Minimum Ventilation	120.6 (c)5	<b>300 cfm</b>
Garage Pressurization	120.6 (c)6	<b>Negative</b>
CO Sensor Requirements	120.6 (c)6	<b>M.3 (CO Note Block)</b>
Ventilation System Acceptance Testing	120.6 (c)8	<b>NRCA-PRC-03 req.</b>
<b>Notes:</b>		
1. Enter the airflow (cfm) of garage exhaust that is being installed under this project.		
2. Detail any exceptions that apply to this project. Reference appropriate exception number from §120.6 where applicable.		
3. Provide equipment tags (e.g. EF-1 & 2 for garage exhaust fans that are part of this project)		
4. Provide references to plans (i.e. Drawing Sheet Numbers) and/or specifications (including Section name/number and relevant paragraphs) where each requirement is specified. Enter "N/A" if the requirement is not applicable to this system.		

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Company:	Signature Date:
Address:	CEA/ HERS Certification Identification (if applicable):
City/State/Zip:	Phone:

RESPONSIBLE PERSON'S DECLARATION STATEMENT	
I certify the following under penalty of perjury, under the laws of the State of California:	
1. The information provided on this Certificate of Compliance is true and correct.	
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).	
3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.	
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.	
5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.	
Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip:	Phone:



CERTIFICATE OF COMPLIANCE		NRCC-PRC-05-E
Commercial Refrigeration		(Page 1 of 5)
Project Name:	Date Prepared:	

<b>General Information</b>
Building Area: <input type="checkbox"/> Retail Food Store Conditioned Area $\geq 8,000 \text{ ft}^2$ <input type="checkbox"/> Retail Food Store Conditioned Area $< 8,000 \text{ ft}^2$
<i>(Note: If the Retail Food Store Conditioned Area is <math>&lt; 8,000 \text{ ft}^2</math> then the Retail Food Store need not comply)</i>
Phase of Construction: <input type="checkbox"/> New Construction <input type="checkbox"/> Addition <input type="checkbox"/> Alteration

<b>DOCUMENTATION AUTHOR'S DECLARATION STATEMENT</b>	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Company:	Signature Date:
Address:	CEA/ HERS Certification Identification (if applicable):
City/State/Zip:	Phone:

<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> <li>The information provided on this Certificate of Compliance is true and correct.</li> <li>I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).</li> <li>The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.</li> <li>The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.</li> <li>I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.</li> </ol>	
Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip:	Phone:

Project Name:

Date Prepared:

**MANDATORY REQUIREMENTS**

Are new condensers replacing existing condensers when:

The attached compressor system total heat of rejection does not increase? Yes  No

Less than 25% of the attached compressors and the attached refrigerated display cases are new? Yes  No

If Yes to both questions for all systems, the condenser(s) need not comply (exception §120.6(b)). Continue to page 3 or 4.

CONDENSER MANDATORY MEASURE	T-24 Sections	Indicate page reference for information on the plans or specification, or list information below					
<b>Condenser ID or Tag (e.g. Cond-1)</b>							
Continuously variable speed fans? Fan speed controlled in unison for all fans serving a common condenser high side?	§120.6(b)1A						
Saturated condensing temperature setpoint reset based on ambient dry bulb temperature for air-cooled condensers and ambient wet bulb temperature for evaporative condensers?	§120.6(b)1B,C						
Specify the minimum saturated condensing temperature setpoint. Complies if the minimum saturated condensing temperature setpoint ≤ 70°F.	§120.6(b)1D						
Minimum allowed condenser efficiency. Reference Table 120.6-C.	§120.6(b)1E						
Installed condenser specific efficiency from worksheet CR-2C							
Is the installed condenser efficiency ≥ the minimum allowed condenser efficiency?		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Exception 1 to §120.6(b)1E.</b> Condenser with total heat rejection capacity of < 150,000 Btuh at the specific efficiency conditions.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Exception 2 to §120.6(b)1E.</b> Condenser operating in Climate Zone 1.		<input type="checkbox"/>					
<b>Exception 3 to §120.6(b)1E.</b> Existing condenser reused for an addition or alteration.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Air-cooled Condenser Installed? If Yes then Fill Out Next 3 Rows</b>	§120.6(b)1F						
Fin density (fins per inch). Complies if fin density ≤10.							
<b>Exception 1 to §120.6(b)1F.</b> Condenser is a micro-channel condenser.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Exception 2 to §120.6(b)1F.</b> Existing condenser is being reused.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Project Name:

Date Prepared:

Existing compressor system reused? If Yes, the compressor system need not comply. Yes  No   
 If **Yes** to both questions for all systems, the condensers need not comply (exception §120.6(b)). Continue to page 4 or 4.

COMPRESSOR SYSTEM MANDATORY MEASURES	T-24 Sections	Indicate page reference for information on the plans or specification, or list information below					
<b>Compressor System / Suction Group ID or Tag (e.g. Rack A)</b>							
Saturated suction temperature setpoint reset based on the temperature requirements of loads?	§120.6(b)2A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Exception 1 to §120.6(b)2A.</b> Single compressor system with no variable capacity capability.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Exception 2 to §120.6(b)2A.</b> Suction group with design saturated suction temperature (SST) ≥ 30°F.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Exception 2 to §120.6(b)2A.</b> Suction group comprises of the high stage of a two-stage or a cascade system.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Exception 2 to §120.6(b)2A.</b> Suction group serves the secondary cooling fluid (e.g. glycol) chiller.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Design Saturated Suction Temperature (SST) ≤ -10°F and Suction Group Design Cooling Capacity Greater than 100MBH? If Yes then Fill Out the Next 3 Rows</b>	§120.6(b)2B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subcooled liquid temperature at the exit of the subcooler. Complies if the temperature is ≤ 50°F.							
Specify the saturated suction temperature (SST) of the suction group doing the subcooling. Complies if SST ≥ 18°F.							
<b>Exception 1 to §120.6(b)2B.</b> Suction group is the low temperature suction group of a cascade system.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<b>REFRIGERATED DISPLAY CASES MANDATORY MEASURES</b>	<b>T-24 Sections</b>	<b>Indicate page reference for information on the plans or specification, or list information below</b>
<b>Refrigerated Display Cases</b>		
Lights in the refrigerated display cases and lights installed on walk-in glass doors automatically turned off during non-business hours, or reduced by 50% of lighting power within 30 minutes after the nearby area is vacated?	§120.6(b)3	Yes No <input type="checkbox"/> <input type="checkbox"/>
<b>Exception 1 to §120.6(b)3.</b> Retail Food Store is open for business for 140 hours or more per week.		<input type="checkbox"/>
<b>HEAT RECOVERY MANDATORY MEASURES</b>	<b>T-24 Sections</b>	<b>Indicate page reference for information on the plans or specification, or list information below</b>
<b>Heat Recovery System ID or Tag (e.g. HR-1)</b>		
Heat recovery of at least 25% of the sum of the total heat rejection of the refrigeration systems with > 150,000 Btuh individual total heat rejection at design conditions?	§120.6(b)4A	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Identify the page in plans showing the heat recovery calculations or attach the calculations to this form.		
<b>Exception 1 to §120.6(b)4A.</b> Retail Food Store located in Climate Zone 15.		<input type="checkbox"/>
<b>Exception 2 to §120.6(b)4A.</b> Reused refrigeration and HVAC systems.		
Identify the page number in plans showing the charge increase calculations or attach the calculations to this form.	§120.6(b)4B	
A Specify the increase in refrigerant charge associated with heat recovery equipment and piping in lbs		
B Specify the total amount of heat recovery heating capacity in MBH [MBH = 1,000 Btuh]		
C A / B. Complies if C < 0.35 lbs/MBH.		

Project Name:

Date Prepared:

### Fan-Powered Condenser Specific Efficiency Worksheet

**EVAPORATIVE CONDENSER**

Tag/ID	Fans				Pumps				Condenser		
	A	B	C	D	E	F	G	H	I	J	K
	Motor Power (HP) <sup>1</sup>	Motor Efficiency	Motor Input Power (kW) 0.746 * A / B	Total Fan Power (kW)	Motor Power (HP)	Motor Efficiency	Motor Input Power (kW) 0.746 * E / F	Total Pump Power (kW)	Capacity (MBH) <sup>2</sup>	Total Input Power (kW) D + H	Specific Efficiency (Btuh/Watt) I / J
	Fan 1 ___ Fan 2 ___ Fan 3 ___	Fan 1 ___ Fan 2 ___ Fan 3 ___	Fan 1 ___ Fan 2 ___ Fan 3 ___		Pump 1 ___ Pump 2 ___	Pump 1 ___ Pump 2 ___	Pump 1 ___ Pump 2 ___				
	Fan 1 ___ Fan 2 ___ Fan 3 ___	Fan 1 ___ Fan 2 ___ Fan 3 ___	Fan 1 ___ Fan 2 ___ Fan 3 ___		Pump 1 ___ Pump 2 ___	Pump 1 ___ Pump 2 ___	Pump 1 ___ Pump 2 ___				

1. Enter the nominal HP for each fan motor. If the manufacturer specifies the input power in kW, then skip to column C and enter it there.
2. Enter the rated capacity of the condenser at 100°F saturated condensing temperature and 70°F ambient wetbulb temperature.

**AIR-COOLED CONDENSER**

Tag/ID	Fans				Condenser	
	A	B	C	D	E	F
	Number of Fans	Motor Power (HP) <sup>1</sup>	Motor Efficiency	Total Input Power (Watts) 746 * A * B / C	Capacity (Btuh) <sup>2</sup>	Specific Efficiency (Btuh/Watt) E / D

1. Enter the nominal HP for each fan motor. If the manufacturer specifies the input power in kW, then skip to column D and enter it there.
2. Enter the rated capacity of the condenser at 105°F saturated condensing temperature and 95°F ambient drybulb temperature (10°F temperature difference).

**COMPRESSED AIR SYSTEM**

CEC-NRCC-PRC-10-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



<b>CERTIFICATE OF COMPLIANCE</b>	<b>NRCC-PRC-10-E</b>
Compressed Air System	(Page 1 of 3)
Project Name:	Date Prepared:

<b>General Information</b>	
Phase of Construction:	<input type="checkbox"/> New Construction <span style="margin-left: 200px;"><input type="checkbox"/> Addition/Alteration</span>
Total System Horsepower:	Proposed: _____ hp <span style="margin-left: 100px;">Current: _____ hp (if applicable)</span>
<ul style="list-style-type: none"> <li><i>If in Addition/Alteration phase of construction and proposed total system horsepower is <math>\leq 1.5</math> multiplied by the current total system horsepower, system is exempt from Trim Compressor and Storage requirement (§120.6(e)1).</i></li> <li><i>If in Addition/Alteration phase of construction and system includes one or more centrifugal compressors, system is exempt from Title 24 requirements (§120.6(e)).</i></li> <li><i>If proposed total system horsepower is <math>&lt; 25</math> hp, system is exempt from Title 24 requirements (§120.6(e)).</i></li> </ul>	
Is the system expected to have a steady load (typical air demand fluctuates less than 10 percent)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <i>(Note: If Yes, system must be approved by the Energy Commission Executive Director.)</i>
Is the system a single compressor system?	<input type="checkbox"/> Yes <input type="checkbox"/> No <i>(Note: If Yes, system is exempt from Controls requirement (§120.6(e)2).)</i>

<b>DOCUMENTATION AUTHOR'S DECLARATION STATEMENT</b>	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Company:	Signature Date:
Address:	CEA/ HERS Certification Identification (if applicable):
City/State/Zip:	Phone:
<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> <li>1. The information provided on this Certificate of Compliance is true and correct.</li> <li>2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).</li> <li>3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.</li> <li>4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.</li> <li>5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.</li> </ol>	
Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip:	Phone:

**COMPRESSED AIR SYSTEM**

CEC-NRCC-PRC-10-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE	NRCC-PRC-10-E
Compressed Air System	(Page 2 of 3)
Project Name:	Date Prepared:

<b>Trim Compressor and Storage Requirements</b>								
<i>Fill out the following sections to ensure compliance with Trim Compressor and Storage requirement (§120.6(e)1).</i>								
<b>System Specifications Table</b>								
Total Online System Capacity (acfm):					Operating Pressure (psi):			
Compressor Specifications:								
Compressor	Size (hp)	Rated Capacity (acfm)	Control Type (check one or fill-in for 'Other')					Acting as Trim Compressor?
			Fixed Speed	Variable Displacement	Variable Speed	Centrifugal	Other	
1								Y / N
2								Y / N
3								Y / N
4								Y / N
5								Y / N
6								Y / N
7								Y / N
8								Y / N
9								Y / N
10								Y / N
If number of compressors exceeds 10, please list the additional compressors with specifications in the following Notes section.								
Notes:								
<b>Largest Net Capacity Increment:</b>			acfm	<i>(Note: This calculation is detailed in the compliance manual section 10.6, where the largest net capacity increment is the largest step in capacity between ordered combinations of base compressors.)</i>				
<b>Do all of the trim compressors have the control type Variable Speed?</b>								<b>Results</b>
<input type="checkbox"/> Yes	<b>If Yes, calculate the total rated capacity of the trim compressor(s),</b>							
	<b>Total Rated Capacity of Trim Compressor(s):</b> acfm							Y / N
	Is the total rated capacity of the trim compressor(s) greater than or equal to 1.25 multiplied by the largest net capacity increment?							
<b>Storage Capacity:</b> gallons							Y / N	
Is the storage capacity greater than or equal to 1 gallons/acfm multiplied by the total rated capacity of the trim compressor(s)?								
<input type="checkbox"/> No	<b>If No, calculate the effective trim capacity of the trim compressor(s).</b>							
	<b>Effective Trim Capacity:</b> acfm							Y / N
	Is the total effective trim capacity greater than or equal to the largest net capacity increment?							
<i>(Note: This calculation is detailed in the compliance manual, section 10.6)</i>							Y / N	
<b>Storage Capacity:</b> gallons								
Is the storage capacity greater than or equal to 2 gallons/acfm multiplied by the total rated capacity of the trim compressor(s)?								

<b>Controls Requirement</b>	<b>Results</b>
<i>Multicompressor systems must perform and document the acceptance test noted below to prove compliance with the Controls requirement (§120.6(e)2). This test is described in the Nonresidential Appendices, NA7.13.</i>	
<b>PROC-01 A</b>	Test Performed By: <span style="border-bottom: 1px solid black; display: inline-block; width: 150px;"></span>
	PASS / FAIL

**PROCESS BOILER REQUIREMENTS**

CEC-NRCC-PRC-11-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE		NRCC-PRC-11-E
Process Boiler Requirements		(Page 1 of 1)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>	

<b>Equipment Tags and System Description<sup>2</sup></b>		<b>B-1</b>		
<b>Boiler Input Capacity (MMBtu/h)<sup>1</sup></b>		<b>2.5 MMBtu/h</b>		
<b>MANDATORY MEASURES</b>	<i>T-24 Sections</i>	<i>Reference to the Requirements in the Contract Documents<sup>3</sup></i>		
Combustion Air Shutoff	120.6 (d)1A & B	<b>M.1 (Note Block)</b>		
Combustion Fan Speed Control	120.6 (d)2	<b>Variable Speed</b>		
Excess Oxygen	120.6 (d)3&4	<b>N/A</b>		
<b>Notes:</b>				
1. Enter the input heating capacity of each process boiler in million Btu per hour (MMBtu/h)				
2. Provide equipment tags (e.g. B-1 & 2 for Boilers that are covered by these requirements).				
3. Provide references to plans (i.e. Drawing Sheet Numbers) and/or specifications (including Section name/number and relevant paragraphs) where each requirement is specified. Enter "N/A" if the requirement is not applicable to this system.				

<b>DOCUMENTATION AUTHOR'S DECLARATION STATEMENT</b>	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Company:	Signature Date:
Address:	CEA/ HERS Certification Identification (if applicable):
City/State/Zip:	Phone:
<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>	
I certify the following under penalty of perjury, under the laws of the State of California:	
1. The information provided on this Certificate of Compliance is true and correct.	
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).	
3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.	
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.	
5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.	
Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip:	Phone:



## §120.6 and the Plans Examiner *cont.*

- **Other NRCC forms req. for covered processes**
  - NRCC-PRC-01 (req. for all projects)
    - Identifies which forms will be required for project
  - NRCC-PRC-06
    - Req. for all refrigerated warehouses
  - NRCC-PRC-07
    - Req. for refrigerated warehouses  $\geq 3,000$  ft<sup>2</sup>
  - NRCC-PRC-08
    - Req. when sum of multiple warehouses  $\geq 3,000$  ft<sup>2</sup> and served by same refrigeration system



CERTIFICATE OF COMPLIANCE		NRCC-PRC-01-E
Process Compliance Forms & Worksheets		(Page 1 of 3)
Project Name:	Date Prepared:	

**PROCESS COMPLIANCE FORMS & WORKSHEETS (check box if worksheet is included)**

*For detailed instructions on the use of this and all Energy Efficiency Standards compliance forms, refer to the 2008 Nonresidential Manual Note: The Enforcement Agency may require all forms to be incorporated onto the building plans.*

YES	NO	Form/Worksheet #	Title
<input type="checkbox"/>	<input type="checkbox"/>	PRC-01-E (1 of 2)	Covered Process Certificate of Compliance. Required on plans for all submittals with covered processes.
<input type="checkbox"/>	<input type="checkbox"/>	PRC-01-E (2 of 2)	Certificate of Compliance, Required Acceptance Tests (PRC-02-A to PRC-8-A). Required on plans for all submittals.
<input type="checkbox"/>	<input type="checkbox"/>	PRC-02-E	Compliance Form for Enclosed Parking Garage Exhaust Fans
<input type="checkbox"/>	<input type="checkbox"/>	PRC-03-E	Compliance Form for Commercial Kitchens
<input type="checkbox"/>	<input type="checkbox"/>	PRC-04-E	Compliance Form for Computer Rooms
<input type="checkbox"/>	<input type="checkbox"/>	PRC-05-E	Compliance Form for Commercial Refrigeration
<input type="checkbox"/>	<input type="checkbox"/>	PRC-06-E	Compliance Form for <b>ALL</b> Refrigerated Warehouses
<input type="checkbox"/>	<input type="checkbox"/>	PRC-07-E	Compliance Form for Refrigerated Warehouse $\geq 3,000$ ft <sup>2</sup>
<input type="checkbox"/>	<input type="checkbox"/>	PRC-08-E	Compliance Form for Refrigerated Warehouse Where <b>Multiple</b> Spaces that (i) comprise a total of 3,000 square feet or more; and (ii) are collectively served by the same refrigeration system compressor(s) and condenser(s) (central systems).
<input type="checkbox"/>	<input type="checkbox"/>	PRC-09-E	Compliance Form for Laboratory Exhaust
<input type="checkbox"/>	<input type="checkbox"/>	PRC-10-E	Compliance Form for Compressed Air Systems
<input type="checkbox"/>	<input type="checkbox"/>	PRC-11-E	Compliance Form for Process Boilers

CERTIFICATE OF COMPLIANCE NRCC-PRC-01-E

Required Acceptance Tests (Page 3 of 3)

Project Name: \_\_\_\_\_ Date Prepared: \_\_\_\_\_

**PROCESS ACCEPTANCE FORMS (check box for required forms)**

**Designer:**  
*This form is to be used by the designer and attached to the plans. Listed below are all the acceptance tests for process systems. The designer is required to check the applicable boxes for all acceptance tests that apply and list all equipment that requires an acceptance test. If all equipment of the same type requires a test, list the equipment description and the number of systems.*

**Installing Contractor:**  
 The contractor who installed the equipment is responsible to either conduct the acceptance test them self or have a qualified entity run the test for them. If more than one person has responsibility for the acceptance testing, each person shall sign and submit the Certificate of Acceptance applicable to the portion of the construction or installation for which they are responsible.

**Enforcement Agency:**  
*Plancheck – The NRCC-PRC-01-E form is not considered a completed form and is not to be accepted by the building department unless the correct boxes are checked.  
 Inspector - Before occupancy permit is granted all newly installed process systems must be tested to ensure proper operations.*

Test Description		PRC-01A	PRC-02A	PRC-03A	PRC-04A	PRC-05A	PRC-06A	PRC-07A	PRC-08A
Equipment Requiring Testing or Verification	# of units	Compressed Air Systems	Kitchen Exhaust	Garage Exhaust	RHW Evap Fan Motor Controls	RHW Evap Condenser Controls	RHW Air-Cooled Condenser Controls	RHW Variable Speed Compressors	RHW Elect. Underslab Heating
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>





## §120.6 and the Field Inspector

- **Verify at Final applicable Certificate of Acceptance**
  - Refer to [NRCC-PRC-01](#)
    - [NRCA-PRC-01](#) (Comp. Air Systems)
    - [NRCA-PRC-03](#) (Garages)
    - NRCA-PRC-04 through -08 (Refrigerated Warehouses)
- **Forms must be registered beginning 1/1/15**



**COMPRESSED AIR SYSTEM ACCEPTANCE**

CEC-NRCA-PRC-01-F (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF ACCEPTANCE		NRCA-PRC-01-F
Compressed Air System Acceptance		(Page 1 of 3)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

<i>Note: Submit one Certificate of Acceptance for each system that must demonstrate compliance.</i>	Enforcement Agency Use: Checked by/Date:
---	--

<b>Intent:</b>	Verify that compressed air system controls are installed and operating correctly.
----------------	---

<b>Construction Inspection</b>
<ol style="list-style-type: none"> <li>Supporting documentation needed to perform test includes: <ol style="list-style-type: none"> <li>2013 Building Energy Efficiency Standards Nonresidential Compliance Manual (<i>NA7.13 Compressed Air Systems Acceptance At-A-Glance</i>).</li> <li>2013 Building Energy Efficiency Standards (<i>Section 120.6(e)</i>).</li> </ol> </li> <li>Instrumentation to perform test may include, but is not limited to: <ol style="list-style-type: none"> <li>Power meter(s) for every compressor</li> <li>Pressure transducer(s) for every compressor</li> <li>Flow meter(s) for every compressor</li> </ol> </li> <li>Installation: (<b>all</b> of the following boxes must be checked) <ul style="list-style-type: none"> <li><input type="checkbox"/> Equipment installation is complete (including compressors, storage, controls, conditioning equipment, piping, etc.)</li> <li><input type="checkbox"/> Compressed air system is ready for system operation, including completion of all start-up procedures per manufacturer's recommendations.</li> </ul> </li> <li>Prior to functional testing, fill out the System Specifications Table. If the number of compressors exceeds the number in this list, please list additional compressors and specifications in the Notes section.</li> <li>Prior to functional testing, document below the method and tools for observing and recording the states of each compressor in the system, as seen in Step 3 of Functional Testing.</li> </ol>

<b>Method for Observing and Recording Compressor States:</b>

**System Specifications Table**

<b>Total Online System Capacity (acfm):</b>	<b>Operating Pressure (psi):</b>
---	----------------------------------

<b>Compressor Specifications:</b>								
Compressor	Size (hp)	Rated Capacity (acfm)	Control Type (check one or fill-in for 'Other')					Acting as Trim Compressor?
			Fixed Speed	Variable Displacement	Variable Speed	Centrifugal	Other	
1								Y / N
2								Y / N
3								Y / N
4								Y / N
5								Y / N
6								Y / N
7								Y / N
8								Y / N
9								Y / N
10								Y / N

If number of compressors exceeds 10, please list the additional compressors with specifications in the following Notes section.

Notes:

# COMPRESSED AIR SYSTEM ACCEPTANCE

CEC-NRCA-PRC-01-F (Revised 06/13)



CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF ACCEPTANCE		NRCA-PRC-01-F
Compressed Air System Acceptance		(Page 2 of 3)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:


A. Functional Testing	Results
<b>Step 1: Verify that the methods from the Construction Inspection have been employed by confirming the following:</b>	
a. Compressor states can be observed and recorded for every compressor.	Y / N
b. The current air demand (in acfm) can be measured or inferred.	Y / N
<b>Step 2: Run the compressed air supply system steadily at a load within (or close to) the expected operational load range as can be practically implemented for a duration of at least 10 minutes. Verify the following:</b>	
a. System is running steadily for at least 10 minutes.	Y / N
b. System is running within (or close to) the expected operational load range.	Y / N
c. Downstream equipment is not affected by test valve being open (if applicable).	Y / N / NA

Step 3: Observe and record the operating states of each compressor and the current air demand during the test.							
					Current Air Demand (acfm)		
Compressor	Compressor States <i>(Check one)</i>			Compressor States <i>(Check all that apply)</i>			Notes:
	<i>Off</i>	<i>Unloaded</i>	<i>Partially Loaded</i>	<i>Fully Loaded</i>	<i>Blowoff</i>	<i>Short Cycling</i>	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

If number of compressors exceeds 10, please list the additional compressors with specifications in the Notes section.

<b>Step 4: Confirm that the system exhibits the following behavior following the test:</b>	
a. No compressor exhibits short-cycling (loading and unloading more often than once per minute).	Y / N
b. No compressor exhibits blowoff (venting compressed air at the compressor itself).	Y / N
c. The trim compressors shall be the only compressors partially loaded, while the base compressors will either be fully loaded or off by the end of the test. (only applicable for new systems)	Y / N / NA
<b>Step 5: Return system to initial operating conditions.</b>	Y / N

B. Testing Results	PASS / FAIL
Step 1: Verify construction inspection steps are complete (all answers are Y).	
Step 2: Run system steadily at operational load range for 10 minutes (all answers are Y or NA).	
Step 3: Record all observed states of the compressors and system demand (Table is filled out).	
Step 4: System exhibits expected behavior (all answers are Y or NA).	

**COMPRESSED AIR SYSTEM ACCEPTANCE**

CEC-NRCA-PRC-01-F (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF ACCEPTANCE		NRCA-PRC-01-F
Compressed Air System Acceptance		(Page 3 of 3)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

<b>C. Evaluation:</b>
<input type="checkbox"/> PASS: All <b>Construction Inspection</b> responses are complete and all <b>Testing Results</b> responses are "Pass"
Notes:

**ENCLOSED PARKING GARAGE EXHAUST SYSTEM ACCEPTANCE**

CEC-NRCA-PRC-03-F (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF ACCEPTANCE		NRCA-PRC-03-F
Enclosed Parking Garage Exhaust System Acceptance		(Page 1 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

<i>Note: Submit one Certificate of Acceptance for each system that must demonstrate compliance.</i>	Enforcement Agency Use: Checked by/Date
---	---

**Intent:** Verify that airside economizers function properly

<b>Construction Inspection</b>	
1. Supporting documentation needed to perform test includes: <ol style="list-style-type: none"> <li>2013 Building Energy Efficiency Standards Nonresidential Compliance Manual (<i>NA7.5.4 Air Economizer Controls Acceptance At-A-Glance</i>).</li> <li>2013 Building Energy Efficiency Standards.</li> </ol>	
2. Instrumentation to perform test includes: <ol style="list-style-type: none"> <li>Space differential pressure sensor Calibration Date: <u>1/1/14</u> (must be within last year)</li> </ol>	
3. Installation: (all of the following boxes should be checked) <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Each CO sensor has a valid factory calibration certificate (+/-5%)</li> <li><input checked="" type="checkbox"/> CO sensors are located in areas of high CO concentration per 120.6(c)</li> <li><input checked="" type="checkbox"/> CO control setpoint is at or below 25ppm for all sensors per 120.6(c)</li> </ul>	
<b>A. Functional Testing</b>	<b>Results</b>
<b>Step 1:</b> During a time of low activity (e.g. after hours or mid-morning or mid-afternoon) verify the following:	
a. All sensors active and reading a setpoint of <25ppm	(Y) N
b. Exhaust fans are running at minimum speed.	(Y) N
c. Exhaust fans are drawing <30 rated power.	(Y) N / NA
<b>Step 2:</b> Apply CO span gas with a concentration of 30 ppm, and a concentration accuracy of +/- 2%, one by one to 50% of the sensors but no more than 10 sensors per garage and to at least one sensor per proximity zone. For each sensor tested observe	
a. All sensors active and reading a setpoint of between 25 and 35ppm	(Y) N
b. Exhaust fans are running at maximum speed.	(Y) N
c. Exhaust fans go back to minimum speed when span gas is removed.	(Y) N / NA
<b>Step 3:</b> Temporarily override the programmed sensor calibration/replacement period to 5 minutes.	
a. Wait 5 minutes and observe that fans ramp to full speed and an EMCS alarm is set	(Y) N
<b>Step 4:</b> Temporarily place the system in unoccupied mode and override the programmed unoccupied sensor alarm differential from 30% for 4 hours to 1% for 5 minutes.	
a. Wait 5 minutes and observe that fans ramp to full speed and an alarm is received by the facility operators. Restore programming.	(Y) N
<b>Step 5:</b> Temporarily override the programmed occupied sensor proximity zone alarm differential from 30% for 4 hours to 1% for 5 minutes.	
a. Wait 5 minutes and observe that fans ramp to full speed and an alarm is received by the facility operators. Restore programming.	(Y) N
<b>B. Testing Results</b>	<b>PASS / FAIL</b>
Steps 1-5: All responses were yes	<input checked="" type="checkbox"/>

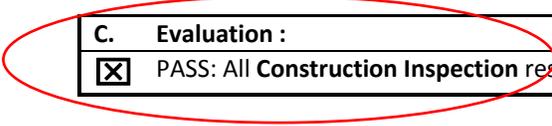
# ENCLOSED PARKING GARAGE EXHAUST SYSTEM ACCEPTANCE

CEC-NRCA-PRC-03-F (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF ACCEPTANCE		NRCA-PRC-03-F
Enclosed Parking Garage Exhaust System Acceptance		(Page 2 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>



<b>C. Evaluation :</b>
<input checked="" type="checkbox"/> <b>PASS: All Construction Inspection</b> responses are complete and all <b>Testing Results</b> responses are "Pass"

<b>Notes:</b>



## §120.6 and the Field Inspector *cont.*

- **NRCA forms req. for covered processes (refrigerated warehouses)**
  - NRCA-PRC-04 (evaporator fan motor controls)
  - NRCA-PRC-05 (evaporative condenser controls)
  - NRCA-PRC-06 (air-cooled condenser controls)
  - NRCA-PRC-07 (variable speed compressor)
  - NRCA-PRC-08 (electric resistance underslab heating)

\* *Acceptance testing for covered processes will not req. a CMATT*



# Insulation

- **New mandatory insulation reqs. in [§120.7](#)**
- **Maximum U-factor for roofs/ceilings**
  - Incl. metal buildings and wood framed
- **Maximum U-factor for walls**
  - Incl. metal buildings and framed, light and heavy mass, wood framed, and spandrel panels and glass curtain walls
- **Maximum U-factor for floors and soffits**
  - Incl. raised mass floors

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## SECTION 120.7 –MANDATORY INSULATION REQUIREMENTS

Any newly constructed nonresidential and high-rise residential and hotel/motel building shall meet the minimum requirements in this Section.

(a) **Roof/Ceiling Insulation.** The opaque portions of the roof/ceiling that separates conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 and 2 below:

1. **Metal Building-** The weighted average U-factor of the roof assembly shall not exceed 0.098.
2. **Wood Framed and Others-** The weighted average U-factor of the roof assembly shall not exceed 0.075.

(b) **Wall Insulation.** The opaque portions of walls that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 6 below:

1. **Metal Building-** The weighted average U-factor of the wall assembly shall not exceed 0.113.
2. **Metal Framed-** The weighted average U-factor of the wall assembly shall not exceed 0.105.
3. **Light Mass Walls-** A 6 inches or greater Hollow Core Concrete Masonry Unit shall have a U-factor not to exceed 0.440.
4. **Heavy Mass Walls-** A 8 inches or greater Hollow Core Concrete Masonry Unit shall have a U-factor not to exceed 0.690.
5. **Wood Framed and Others-** The weighted average U-factor of the wall assembly shall not exceed 0.110.
6. **Spandrel Panels and Glass Curtain Wall-** The weighted average U-factor of the Glass spandrel panels and glass curtain wall assembly shall not exceed 0.280.

(c) **Floor and Soffit Insulation.** The opaque portions of floors and soffits that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 and 2 below:

1. **Raised Mass Floors-** Shall have a minimum of 3 inches of lightweight concrete over a metal deck or the weighted average U-factor of the floor assembly shall not exceed 0.269.
2. **Other Floors-**The weighted average U-factor of the floor assembly shall not exceed 0.071.
3. **Heated Slab Floor-**A heated slab floor shall be insulated to meet the requirements of Section 110.8(g)



# §120.7 and the Plans Examiner

- **Still verify U-factor on NRCC-ENV-01 (Section B)**
  - Envelope Details
  - Must meet or be below mandatory maximum values
- **Still verify R-values on building plans**
  - Structural/Architectural Plans

STATE OF CALIFORNIA  
**ENVELOPE COMPONENT APPROACH**  
 CED-NRCC-ENV-01-E (Revised 2013) CALIFORNIA ENERGY COMMISSION

**CERTIFICATE OF COMPLIANCE** NRCC-ENV-01-E  
 Envelope Component Approach (Page 1 of 3)  
 Project Name: 2013 CALBO Training Sample Date Prepared: 01/01/14

**A. GENERAL INFORMATION**

1	Project Location:	2013 CALBO Drive	6	Compliance Method:	<input checked="" type="checkbox"/> Component <input type="checkbox"/> Unconditioned (file Affidavit)
2	CA City and Zip Code:	Sacramento, 95814	7	Building Front Orientation (deg or cardinal):	North
3	Climate Zone:	12	8	Permitted Scope of Work:	<input checked="" type="checkbox"/> New Construction <input type="checkbox"/> Addition <input type="checkbox"/> Alteration
4	Total Conditioned Floor Area:	2,000 ft <sup>2</sup>	9	Building Type(s):	<input checked="" type="checkbox"/> Nonresidential <input type="checkbox"/> High-Rise Residential <input type="checkbox"/> Hotel/Motel Guest Room
5	<input type="checkbox"/> Schools (Public School) <input type="checkbox"/> Relocatable Public School Bldg. <input type="checkbox"/> Conditioned Spaces <input type="checkbox"/> Unconditioned Spaces <input type="checkbox"/> Skylight Area for Large Enclosed Space ≥ 3000 ft <sup>2</sup> (If checked include the NRCC-ENV-04-E with submittal)				

**B. ENVELOPE DETAILS – Framed**

1	2	3	4	5	6	7	8	9	10	11
Tag/ID	Assembly Type	Frame Material	Frame Depth	Frame Spacing	Appendix JA4 Reference	Cavity R-value	Continuous Insulation R-value	Proposed U-Factor	Required U-Factor From Tables, B, C, D	Comments
1	Ceiling	Wood	2 X 4	16 in.	4.2.1	R-38	R-0	0.026	0.039	
2	Walls	Wood	2 X 6	16 in.	4.3.1	R-19	R-4	0.074	0.059	
3										

**C. ENVELOPE DETAILS – Non-framed**

1	2	3	4	5	6	7	8	9	10
Tag/ID	Assembly Type	Assembly Materials	Thickness (inches)	Interior or Core Insulation R-value	Continuous Insulation R-value	Appendix JA4 Reference	Proposed U-Factor	Required U-Factor from Tables, B, C, D	Comments

**D. ENVELOPE DETAILS – Mass**

1	2	3	4	5	6	7	8	9	10	11
Tag/ID	Mass Type	Density (lb/ft <sup>3</sup> )	Mass Thickness (inches)	Furring Strip Thickness (inches)	Interior Insulation R-value	Exterior Insulation R-value	Appendix JA4 Reference	Proposed Insulation U-Factor	Required U-Factor from Tables, B, C, D	Comments

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance June 2013

\* Can req. a note block on structural/architectural plans

**ENVELOPE COMPONENT APPROACH**

CEC-NRCC-ENV-01-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE	NRCC-ENV-01-E
Envelope Component Approach <span style="float: right;">(Page 1 of 3)</span>	
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>

A. GENERAL INFORMATION											
1	Project Location:	<b>2013 CALBO Drive</b>				6	Compliance Method:	<input checked="" type="checkbox"/> Component <input type="checkbox"/> Unconditioned (file Affidavit)			
2	CA City and Zip Code:	<b>Sacramento, 95814</b>				7	Building Front Orientation (deg or cardinal):	<b>North</b>			
3	Climate Zone:	<b>12</b>				8	Permitted Scope of Work	<input checked="" type="checkbox"/> New Construction <input type="checkbox"/> Addition <input type="checkbox"/> Alteration			
4	Total Conditioned Floor Area:	<b>2,000 ft<sup>2</sup></b>				9	Building Type(s)	<input checked="" type="checkbox"/> Nonresidential <input type="checkbox"/> High-Rise Residential <input type="checkbox"/> Hotel/Motel Guest Room			
5	<input type="checkbox"/> Schools (Public School) <input type="checkbox"/> Relocatable Public School Bldg. <input type="checkbox"/> Conditioned Spaces <input type="checkbox"/> Unconditioned Spaces <input type="checkbox"/> Skylight Area for Large Enclosed Space $\geq 5000 \text{ ft}^2$ (If checked include the NRCC-ENV-04-E with submittal)										

B. ENVELOPE DETAILS – Framed										
1	2	3	4	5	6	7	8	9	10	11
Tag/ID	Assembly Type	Frame Material	Frame Depth	Frame Spacing	Appendix JA4 Reference	Cavity R-value	Continuous Insulation R-value	Proposed U-Factor	Required U-Factor From Tables, B, C, D	Comments
1	<b>Celing</b>	<b>Wood</b>	<b>2 X 4</b>	<b>16 in.</b>	<b>4.2.1</b>	<b>R-38</b>	<b>R-0</b>	<b>0.026</b>	<b>0.039</b>	
2	<b>Walls</b>	<b>Wood</b>	<b>2 X 6</b>	<b>16 in.</b>	<b>4.3.1</b>	<b>R-19</b>	<b>R-4</b>	<b>0.074</b>	<b>0.059</b>	
3										

C. ENVELOPE DETAILS – Non-framed										
1	2	3	4	5	6	7	8	9	10	
Tag/ID	Assembly Type	Assembly Materials	Thickness (inches)	Interior or Core Insulation R-value	Continuous Insulation R-value	Appendix JA4 Reference	Proposed U-Factor	Required U-Factor from Tables, B, C, D	Comments	

D. ENVELOPE DETAILS – Mass										
1	2	3	4	5	6	7	8	9	10	11
Tag/ID	Mass Type	Density (lb/ft <sup>3</sup> )	Mass Thickness (inches)	Furring Strip Thickness (inches)	Interior Insulation R-value	Exterior Insulation R-value	Appendix JA4 Reference	Proposed Insulation U-factor	Required U-Factor from Tables, B, C, D	Comments



## §120.7 and the Field Inspector



- **Verify installed R-values:**
  - Still verify wall and raised floor insulation at Insulation Stage
  - Still verify ceiling insulation at Final
  - Values must meet or exceed NRCC-ENV-01 form
- **Verify R-values on NRCI-ENV-01 form**
  - Must be registered starting 1/1/15





# Building Commissioning

- **New mandatory commissioning reqs. in [§120.8](#)**
- **Applicable to all nonresidential buildings**
  - Buildings < 10,000 ft<sup>2</sup> only have to meet subsections (d) and (e)
- **Requirements for:**
  - Owner's Project Requirements (OPR)
  - Basis of Design (BOD)
  - Design Phase Design Review
  - Commissioning Documents on Plans
  - Commissioning Plan
  - Functional Testing
  - Documentation and Training
  - Commissioning Report

---

## SECTION 120.8 BUILDING COMMISSIONING

For all new nonresidential buildings, the Subsections of 120.8 (a) through (i) for building commissioning shall be included in the design and construction processes of the building project to verify that the building energy systems and components meet the owner's or owner representative's project requirements. All building systems and components covered by Sections 110.0, 120.0, 130.0, and 140.0 shall be included in the scope of the commissioning requirements in this Section, excluding covered processes. **For buildings less than 10,000 ft<sup>2</sup>, only the design review requirements in Sections 120.8(d) and 120.8(e) shall be completed.**

(a) **Summary of Commissioning Requirements.** The following items shall be completed:

1. Owner's or owner representative's project requirements;
2. Basis of design;
3. Design phase design review;
4. Commissioning measures shown in the construction documents;
5. Commissioning plan;
6. Functional performance testing;
7. Documentation and training; and
8. Commissioning report.

(b) **Owner's or Owner Representative's Project Requirements (OPR).** The energy-related expectations and requirements of the building shall be documented before the design phase of the project begins. This documentation shall include the following:

1. Energy efficiency goals;
3. Ventilation requirements;
4. Project program, including facility functions and hours of operation, and need for after hours operation; and
5. Equipment and systems expectations.

**EXCEPTION to Section 120.8(b): Buildings less than 10,000 ft<sup>2</sup>.**

(c) **Basis of Design (BOD).** A written explanation of how the design of the building systems meets the OPR shall be completed at the design phase of the building project, and updated as necessary during the design and construction phases. The Basis of Design document shall cover the following systems:

1. Heating, ventilation, air conditioning (HVAC) systems and controls;
2. Indoor lighting system and controls; and
3. Water heating systems and controls; and
4. Covered processes.

**EXCEPTION to Section 120.8(c): Buildings less than 10,000 ft<sup>2</sup>.**

(d) **Design Phase Design Review.**

1. **Design Reviewer Requirements.** For buildings less than 10,000 ft<sup>2</sup>, design phase design review may be completed by the design engineer. Buildings between 10,000 and 50,000 ft<sup>2</sup> require completion of the Design Review Checklist by either an engineer in-house to the design firm but not associated with the building project, or a third party design engineer. For buildings larger than 50,000 ft<sup>2</sup> or for buildings with complex mechanical systems, an independent, review of these documents by a third party design engineer is required.

2. **Design Review.** During the schematic design phase of the building project, the owner or owner's representative, design team and design reviewer must meet to discuss the project scope, schedule and how the design reviewer will coordinate with the project team. The building owner or owner's representative shall include the Design Review Checklist compliance form in the Certificate of Compliance documentation (see Section 10-103).
3. **Construction Documents Design Review.** The Construction Documents Design Review compliance form lists the items that shall be checked by the design reviewer during the construction document review. The completed form shall be returned to the owner and design team for review and sign-off. The building owner or owner's representative shall include this Construction Documents Design Review compliance form in the Certificate of Compliance documentation (see Section 10-103).

(e) **Commissioning measures shown in the construction documents.** Include commissioning measures or requirements in the construction documents (plans and specifications). Commissioning measures or requirements should be clear, detailed and complete to clarify the commissioning process. These requirements should include the list of systems and assemblies commissioned, testing scope, roles and responsibilities of contractors, requirements for meetings, management of issues, the commissioning schedule, operations and maintenance manual development and of training, and checklist and test form development, execution and documentation. Include, for information only, roles of non-contractor parties.

(f) **Commissioning Plan.** Prior to permit issuance a commissioning plan shall be completed to document how the project will be commissioned and shall be started during the design phase of the building project. The Commissioning Plan shall include the following:

1. General project information; and
2. Commissioning goals; and
3. Systems to be commissioned; and
4. Plans to test systems and components, which shall include:
  - A. An explanation of the original design intent; and
  - B. Equipment and systems to be tested, including the extent of tests; and
  - C. Functions to be tested; and
  - D. Conditions under which the test shall be performed; and
  - E. Measurable criteria for acceptable performance; and
  - F. Commissioning team information; and
  - G. Commissioning process activities, schedules and responsibilities. Plans for the completion of commissioning requirements listed in Sections 120.8(g) through 120.8(i) shall be included.

**EXCEPTION to Section 120.8(f): Buildings less than 10,000 ft<sup>2</sup>.**

(g) **Functional performance testing.** Functional performance tests shall demonstrate the correct installation and operation of each component, system and system-to-system interface in accordance with the acceptance test requirements in Sections 120.5, 120.6, 130.4 and 140.9. Functional performance testing reports shall contain information addressing each of the building components tested, the testing methods utilized, and include any readings and adjustments made.

**EXCEPTION to Section 120.8(g): Buildings less than 10,000 ft<sup>2</sup>.**

(h) **Documentation and training.** A Systems Manual and Systems Operations Training shall be completed.

1. **Systems manual.** Documentation of the operational aspects of the building shall be completed within the Systems Manual and delivered to the building owner or representative and facilities operator. The Systems Manual shall include the following:
  - A. Site information, including facility description, history and current requirements; and
  - B. Site contact information; and

- C. Instructions for basic operations and maintenance, including general site operating procedures, basic troubleshooting, recommended maintenance requirements, and a site events log; and
  - D. Description of major systems; and
  - E. Site equipment inventory and maintenance notes; and
  - F. A copy of all special inspection verifications required by the enforcing agency or the Standards.
2. **Systems operations training.** The training of the appropriate maintenance staff for each equipment type or system shall be documented in the commissioning report. Training materials shall include the following:
- A. System and equipment overview (i.e., what the equipment is, what it does and with what other systems or equipment it interfaces)
  - B. Review and demonstration of operation, servicing and preventive maintenance procedures
  - C. Review of the information in the Systems Manual
  - D. Review of the record drawings on the systems and equipment

**EXCEPTION to Section 120.8(h): Buildings less than 10,000 ft<sup>2</sup>.**

- (i) **Commissioning report.** A complete report of commissioning process activities undertaken through the design, construction and reporting recommendations for post-construction phases of the building project shall be completed and provided to the owner or representative.

**EXCEPTION to Section 120.8(i): Buildings less than 10,000 ft<sup>2</sup>.**



## Building Commissioning *cont.*

- **Design reviewer is responsible for verifying that forms, plans, etc. comply with §120.8**
  - Review may be completed by:
    - Design engineer for buildings  $< 10,000$  ft<sup>2</sup>
    - An in-house engineer not associated with the project, or a third party design engineer for buildings between 10,000 ft<sup>2</sup> and 50,000 ft<sup>2</sup>
    - A third party design engineer for buildings  $> 50,000$  ft<sup>2</sup>, or buildings with complex mechanical systems



# §120.8 and the Plans Examiner

STATE OF CALIFORNIA  
DESIGN REVIEW KICKOFF  
CERTIFICATE OF COMPLIANCE – DATA FIELD DEFINITIONS AND CALCULATIONS  
NRCC-CXR-01-E  
(Page 1 of 1)

Project Name: 2013 CALBO Training Sample      Data Provider: 010114

**A. General Information:**  
Climate Zone: 12      Building Type: New  
Reviewer's Name: Ms. Design Engineer  
Enforcement Agency: Local Jurisdiction

Enforcement Agency Use: Checked by \_\_\_\_\_

DATE OF DESIGN REVIEW KICKOFF \_\_\_\_\_  
DESIGN REVIEW CHECKLISTS PROVIDED TO DESIGN TEAM \_\_\_\_\_

**DESIGN REVIEWER QUALIFICATIONS:**  
 <10,000 ft<sup>2</sup>, design engineer  
 >10,000 ft<sup>2</sup> and <50,000ft<sup>2</sup>, in-house engineer not associated  
 >50,000 ft<sup>2</sup> or complex mechanical system: third-party design

**LIST OF MEETING ATTENDEES:**  
 Owner: Joe Chaver       Designer  
 Project Manager: Tim Mangan       Design

**DOCUMENTS RECEIVED BY DESIGN REVIEWER FOR DESIGN REVIEW:**  
 Owner's Project Requirements       Basis of Design  
 Drawing Set (issue & date): 01/01/14  
 Specifications: Mech. Plans, Structural, El.

**DESIGN REVIEW MEETING TOPICS:**

**PROJECT SCOPE:**  
Shopping mall

**DESIGN ELEMENTS AND ASSUMPTIONS:**  
10% above Title 24 Code

**HVAC SYSTEM SELECTION:**  
Simple HVAC – roof packaged units

**RECOMMENDED ENERGY EFFICIENCY MEASURES:**  
Cool roof on flat roof

**OTHER COMMENTS:**

**COORDINATION:**  
TARGET CONSTRUCTION DOCUMENT REVIEW DATE: \_\_\_\_\_  
TARGET PERMIT SUBMITTAL DATE: \_\_\_\_\_

CA Building Energy Efficiency Standards – 2013 Nonresidential Compliance

STATE OF CALIFORNIA  
CONSTRUCTION DOCUMENTS  
CERTIFICATE OF COMPLIANCE  
NRCC-CXR-03-E  
(Page 1 of 1)

Project Name: 2013 CALBO Training Sample      Data Provider: 010114

**General Information:**  
Climate Zone: 12      Building Type: New Construction      Conditioned Area (sf): 2,500 R2  
Reviewer's Name: Ms. Design Reviewer      Reviewer's Agency: Best Energy Comp.  
Enforcement Agency: Local Jurisdiction      Permit Number: 010113

Enforcement Agency Use: Checked by \_\_\_\_\_      Enforcement Agency Use: Date: \_\_\_\_\_

Code Section	Measure	Design Reviewer		Designer Response	
		Yes/Complies	Does Not Comply/Consider Better Practice	Complies/Will Include in Next Draft	Not Included - State Reason
<b>DESIGN – FAN SYSTEMS</b>					
120.1(e)	Measured outdoor air rates of constant volume mechanical ventilation and space-conditioning systems shall be within 10% of required outside air rate.	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
140.4(c)(1)	Fan power index at design conditions meets the following: 0.8 watts per cfm supply air for constant volume fan systems with total horsepower over 25 hp	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
	<i>Best Practices: Fans appear to be correctly sized for application, accounting for a factor of safety, diversity and redundancy issues.</i>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>CONTROLS</b>					
110.2(c)	Controls for unitary single zone, air conditioners, heat pumps and furnaces must have a setback thermostat.	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
140.4(m)	Cooling systems identified in Table 140.4-D have fan controls to vary the indoor fan airflow as a function of load: 1. DX and chilled water cooling systems that control capacity based on occupied space temperature have a minimum of 2 stages of control with no more than 66% speed operating at stage 1 and draw no more than 40% of fan power at full fan speed when operating at 66% speed. 2. Systems that control space temperature by modulating airflow to the space have proportional fan control such that at 50% air flow the power draw is no more than 30% of fan power at full fan speed. 3. Systems with air side economizer have a minimum of 2 speeds of fan control during economizer operation.	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
<b>NOTES</b>					

CA Building Energy Efficiency Standards – 2013 Nonresidential Compliance      June 2013

- **Verify applicable Certificate of Compliance on plans**
  - NRCC-CXR-01
  - [NRCC-CXR-02](#)
  - NRCC-CXR-03 (simple HVAC)
  - [NRCC-CXR-04](#) (complex HVAC)
  - [NRCC-CXR-05](#)
- **Verify qualifications of design reviewer**

*\* Form must be registered starting 1/1/15*

**DESIGN REVIEW KICKOFF**

CEC-NRCC-CXR-01-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE – DATA FIELD DEFINITIONS AND CALCULATIONS		NRCC-CXR-01-E
Design Review Kickoff		(Page 1 of 1)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>	

<b>A. General Information</b>	
Climate Zone: <b>12</b>	Building Type: <b>New Construction</b> Conditioned Area (sf): <b>5,000 ft<sup>2</sup></b>
Reviewer's Name: <b>Ms. Design Engineer</b>	Reviewer's Agency: <b>Best Energy Comp.</b>
Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Enforcement Agency Use: Checked by	Enforcement Agency Use: Date
<b>DATE OF DESIGN REVIEW KICKOFF</b>	<b>01 / 01 / 14</b>
<b>DESIGN REVIEW CHECKLISTS PROVIDED TO DESIGN TEAM</b>	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
<b>DESIGN REVIEWER QUALIFICATIONS:</b>	
<input checked="" type="checkbox"/> <10,000 ft <sup>2</sup> : design engineer	
<input type="checkbox"/> >10,000 ft <sup>2</sup> and <50,000ft <sup>2</sup> : in-house engineer not associated with project or third-party design engineer	
<input type="checkbox"/> >50,000 ft <sup>2</sup> or complex mechanical system: third-party design engineer	
<b>LIST OF MEETING ATTENDEES:</b>	
<input checked="" type="checkbox"/> Owner: <b>Joe Owner</b>	<input checked="" type="checkbox"/> Design Reviewer: <b>Ms. Design Engineer</b>
<input checked="" type="checkbox"/> Project Manager: <b>Jill Manager</b>	<input checked="" type="checkbox"/> Design Engineer(s): <b>Ms. Design Engineer</b>
<b>DOCUMENTS RECEIVED BY DESIGN REVIEWER FOR DESIGN REVIEW KICKOFF:</b>	
<input checked="" type="checkbox"/> Owner's Project Requirements	<input checked="" type="checkbox"/> Basis of Design or Narrative
<input checked="" type="checkbox"/> Drawing Set (issue & date): <b>01/01/14</b>	
<input checked="" type="checkbox"/> Specifications: <b>Mech. Plans, Structural, Electrical</b>	<input type="checkbox"/> Other: _____
<b>DESIGN REVIEW MEETING TOPICS:</b>	

<b>PROJECT SCOPE:</b> <b>Shopping mall</b>	
<b>DESIGN ELEMENTS AND ASSUMPTIONS:</b> <b>10% above Title 24 Code</b>	
<b>HVAC SYSTEM SELECTION:</b> <b>Simple HVAC – roof packaged units</b>	
<b>RECOMMENDED ENERGY EFFICIENCY MEASURES:</b> <b>Cool roof on flat roof</b>	
<b>OTHER COMMENTS:</b>	
<b>COORDINATION:</b>	
<b>TARGET CONSTRUCTION DOCUMENT REVIEW DATE:</b>	<b>01/01/14</b>
<b>TARGET PERMIT SUBMITTAL DATE:</b>	<b>05/01/14</b>

**COMMISSIONING – CONSTRUCTION DOCUMENTS**

CEC-NRCC-CXR-02-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE	NRCC-CXR-02-E
Commissioning - Construction Documents <span style="float: right;">(Page 1 of 7)</span>	
Project Name:	Date Prepared:

General Information		
Climate Zone:	Building Type:	Conditioned Area (sf):
Reviewer's Name:		Reviewer's Agency:
<i>Note: Design Review for each system/subsystem must be submitted</i>		
Enforcement Agency:	Permit Number:	
Enforcement Agency Use: Checked by	Enforcement Agency Use: Date	

Code Section	Measure	Design Reviewer			Designer Response		
		Yes. Complies	Does Not Comply	Consider Better Practice	Complies	Will Include in Next Draft	Not Included - State Reason
<b>ENVELOPE</b>							
<b>JOINTS AND OTHER OPENINGS</b>							
110.7	Plans indicate that joints, penetrations and other openings in the building envelope shall be sealed to limit infiltration and exfiltration.			N/A			
120.7	Roof/ceiling, wall and floor and soffit insulation must meet requirements identified in this section.			N/A			
<b>INSULATION AND ROOFING PRODUCTS</b>							
140.3(a)1.A	Roofing products for low-sloped roofs meet minimum solar reflectance of 0.63 and minimum thermal emittance of 0.75 OR minimum Solar Reflectance Index of 75. Steep-sloped roofs meet requirements of 0.20 and 0.75 OR 16, respectively.			N/A			
140.3(a)1.A-B	Exterior roofs, ceilings, and exterior walls, floors and soffits must have an overall assembly U-factor no greater than the applicable value in TABLE 140.3-B, C or D.			N/A			
<b>NOTES</b>							
<b>LIGHTING</b>							
<b>LIGHTING CONTROLS</b>							
130.1(a)	Accessible, independent switching or a control device is included for all areas enclosed by ceiling height partitions.			N/A			
130.1(a)4	General lighting is controlled separately from all other lighting systems.			N/A			



CERTIFICATE OF COMPLIANCE		NRCC-CXR-02-E	
Commissioning - Construction Documents		(Page 2 of 7)	
Project Name:		Date Prepared:	

130.1(b)	General lighting of enclosed spaces 100 sf or larger with a lighting load that exceeds 0.5 W/sf, have multi level lighting controls from at least one of the following methods: manual dimming, lumen maintenance, tuning, automatic daylighting controls, demand responsive lighting controls. Control steps are in accordance with Table 130.1-A.			N/A			
130.1(c)	Shut off controls are controlled with occupant sensing controls, automatic time-switch control, signal from another building system or other control and are shown for all indoor lighting systems.			N/A			
130.1(c)5	Offices 250 square feet or smaller; multipurpose rooms of less than 1000 square feet, and classrooms and conference rooms of any size, shall be equipped with occupant sensor(s) to shut off the lighting.			N/A			
130.1(c)6	Lighting in corridors and stairwells shall be controlled by occupant sensing controls that separately reduce lighting power in each space by at least 50% when the area is unoccupied.			N/A			
130.1(e)	For buildings greater than 10,000 sf, demand response controls should be included to reduce total building lighting power by a minimum of 15%.			N/A			
<b>DAYLIGHT AREA</b>							
140.3(c)	Daylight areas required for conditioned or unconditioned spaces greater than 5,000 ft <sup>2</sup> of roof area and with ceiling height greater than 15 feet are shown on building plans and meet requirements of this section.			N/A			
<b>DAYLIGHT CONTROLS</b>							
130.1(d)2	All skylit daylit zones, primary sidelit daylit zones and secondary sidelit daylit zone are shown on plans. Controls of skylit and sidelit zones are independent and provide multi-level lighting in accordance with Table 130.1-A. Plans should indicate that general lighting power is reduced by a minimum of 65% when daylit illuminance is 150% of design illuminance.			N/A			
Best Practice	<i>The locations of all photo sensors are shown on the plans. Height and position criteria are also shown. Photo sensors are not installed in direct sunlight nor in direct light of lighting fixtures.</i>						
Best Practice	<i>Specification defines the amount of light to be gathered by the photo sensor in relation to its location for the lighted surface and this matches the application. For example: if 5 FC on the horizontal floor is the maintained lighting level and the sensor is mounted 15 feet off the ground, the sensor must be capable of detecting 5 FC from floor at that distance.</i>						
Best Practice	<i>Daylight dimming zones have consistent window/glazing types and orientation (e.g., a single zone should not include east and south facing glass or have a section of tall window-wall and another wall section of smaller windows).</i>						
Best Practice	<i>Specifications state that sensor and dimming settings are set up and calibrated after furniture and final finishes and all lighting equipment are installed and operational.</i>						



CERTIFICATE OF COMPLIANCE		NRCC-CXR-02-E					
Commissioning - Construction Documents		(Page 3 of 7)					
Project Name:				Date Prepared:			

Best Practice	<i>A complete step by step sequence of operation is included defining the lighting levels (max and min), zones, interaction with occupants, interaction with occupancy and time-clock controls, and interaction with lighting on-off or dimming switches.</i>						
Best Practice	<i>Interface with BAS or other lighting control systems is defined and is fully compatible for all features of the sequence required. Interface shown on lighting and controls drawings.</i>						
Best Practice	<i>Daylight dimming controls are properly integrated with emergency fixtures, using separate ballasts for dimming and emergency backup.</i>						
Best Practice	<i>Daylight zones that penetrate more than one row of fixtures from the windows have the fixtures closer to the windows receiving a lower light command to create a more even lighting and save energy.</i>						
Best Practice	<i>The ballast specified is able to turn down as low as the specified daylight dimming system.</i>						
Best Practice	<i>To save energy, dimming specifications require that the illumination during night time shall be adjusted to be 20% or more lower than the daytime target, since the apparent illumination at night will appear higher.</i>						

**OUTDOOR LIGHTING CONTROLS AND EQUIPMENT**

130.2(a)	Outdoor incandescent lighting rated over 100 watts is controlled by a motion sensor.			N/A			
130.2(c)1	All outdoor lighting is controlled by photocontrol or outdoor astronomical time-switch control.			N/A			
130.2(c)3	Outdoor lighting where bottom of luminaire is mounted 24 feet or less above the ground is controlled by motion sensors or other controls that are capable of reducing the lighting power of each luminaire by 40 to 80% in response to the area being vacated.			N/A			
130.2(c)4	Automatic lighting controls shown on plans for building façade, ornamental hardscape or outdoor dining lighting includes part-night lighting control, motion sensor control, or time-based control.			N/A			

**NOTES**

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**SERVICE HOT WATER HEATING**

110.3(c)2	SHW systems with circulating pumps or with electrical heat trace have automatic controls that turn off the system during unoccupied periods.			N/A			
120.3	Pipe insulation for space conditioning and service water-heating with fluid temperatures listed in Table 120.3-A have insulation levels as specified in subsection (a) and (b).			N/A			



CERTIFICATE OF COMPLIANCE		NRCC-CXR-02-E
Commissioning - Construction Documents		(Page 4 of 7)
Project Name:	Date Prepared:	

**NOTES****HVAC DESIGN - ALL BUILDINGS****HVAC EQUIPMENT**

110.2(a)	Equipment meets efficiency requirements of Tables 110.2-A through 110.2-K.						
120.2(i)	All air-cooled, unitary, DX units (packaged, split-system, heat pumps and VRF) with economizers are equipped with Fault Detection and Diagnostics systems.						
120.3	Pipe insulation for space conditioning and service water-heating with fluid temperatures listed in Table 120.3-A have insulation levels as specified in subsection (a) and (b).						
140.4(a)	Mechanical heating and cooling equipment are the smallest size, within the available options of the desired equipment line, necessary to meet the design heating and cooling loads of the building, as calculated according to the requirements of Section 140.4(b).						
140.4(c)4	HVAC motors for fans that are less than 1 hp and 1/12 hp or greater are ECM or have a minimum motor efficiency of 70%. Motors also have means to adjust motor speed for balancing or remote control.						
140.4(g)	Electric resistance heating systems are not provided for space heating for cases where exceptions are not allowed.						
Best Practice	<i>In drier climates and when large outdoor air fractions are required, evaporative pre-cooling packages were evaluated to pre-cool outside air and cool the air flowing over the DX condensing unit.</i>						
Best Practice	<i>In semi-arid climates, two-stage evaporative cooling has been evaluated in lieu of mechanical refrigeration.</i>						

**HVAC ZONING**

Best Practice	<i>Zone each air handler to serve only areas with common loads to allow more aggressive control strategies and improve comfort. Have different AHU's serving core vs. perimeter areas.</i>						
Best Practice	<i>The design accommodates partial occupancy energy savings when the owner's requirements or narrative describe any possibility of partial occupancy, by zoning air handlers by floor or by part of a floor, or by incorporating controlled floor dampers, or VAV air terminals going totally shut when not occupied, etc.</i>						

**CONTROLS**



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120.2(a) and (b)	Each zone is controlled by an individual thermostatic control. Controls are capable of setting temperatures to 55°F for heating and 85°F for cooling and provide a temperature deadband of at least 5°F if controlling both heating and cooling.						
120.2(e)	Each space conditioning system is equipped with controls to shut the system off during periods of nonuse and will temporarily operate the system to maintain setback and setup temperatures while keeping ventilation dampers closed.						
120.2(e)3	Systems serving multipurpose rooms less than 100 sf and classrooms, conference, auditorium or meeting center rooms greater than 750 sf have occupancy sensors that interface with HVAC controls to automatically setup the cooling setpoint by 2F or more and setback the heating setpoint by 2F or more and automatically reset the minimum required ventilation rate. These occupant sensor ventilation control devices must meet the requirements of section 120.1(c)5.						
120.2(f)	Outdoor air supply and exhaust equipment shall be installed with dampers that automatically close upon fan shutdown.						
120.2(g)	Each space-conditioning system serving multiple zones with a combined conditioned floor area of more than 25,000 square feet shall be designed, installed, and controlled to serve isolation areas.						
120.2(h)	HVAC systems with DDC to the Zone level shall be programmed to allow centralized demand shed for non-critical zones.						
140.4(d)	Zone controls prevent reheating, recooling and simultaneous provisions of heating and cooling to the same zone.						
<i>Best Practice</i>	<i>Each wall mounted thermostat is located away from potential sources that would adversely affect the reading (close to copiers, direct sunlight, below or above a supply air diffuser or convector, etc.). Any thermostats mounted on exterior walls are installed in sealed and insulated junction boxes.</i>						
<i>Best Practice</i>	<i>Corner office should always have their own thermostats, air terminal boxes or fin-tube radiators.</i>						
<i>Best Practice</i>	<i>Multiple air terminal boxes in a single large open space are served by a single thermostat, or multiple thermostat signals are polled and altered, to prevent fighting of terminals and simultaneous heating and cooling.</i>						
<i>Best Practice</i>	<i>Control sequences are listed for equipment operated by stand-alone packaged controls. Unoccupied sequences should be included.</i>						
<i>Best Practice</i>	<i>Control sequences exist for each piece of equipment listed in the equipment schedule that is monitored or controlled by the building automation system (BAS). Unoccupied sequences should be included.</i>						
<i>Best Practice</i>	<i>Outside air temperature sensors should be in a commercially designed solar shield located on a north wall or some other location out of direct sunlight and away from building exhaust or heat rejection equipment.</i>						

**VENTILATION RATES**



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120.1(a)2	The outdoor air-ventilation rate and air-distribution assumptions made in the design of the ventilating system are clearly identified on the plans.						
120.1(b)	Each space is designed to have natural ventilation OR mechanical ventilation that is no less than the larger of conditioned floor area times the requirements in Table 120.1-A or 15 cfm times the expected number of occupants.						
<i>Best Practice</i>	<i>The minimum and maximum outdoor air rates for each air handler are listed on the equipment schedules.</i>						
<i>Best Practice</i>	<i>The outdoor air-ventilation rates are based on planned owner occupancy as defined in owner's design intent and are not based on maximum egress occupancy rates.</i>						
<i>Best Practice</i>	<i>Heat recovery is specified on fan systems where the design outside air flow rate is greater than 70% and design supply air flow rate is greater than 5,000 cfm.</i>						

**DEMAND CONTROL VENTILATION (DCV)**

120.1(c)3-4	HVAC systems that have an economizer, serve a space with a design occupant density greater than or equal to 25 people per 1000 sf, and are either a single zone system with any controls or multiple zone system with DDC controls to the zone level must have demand control ventilation controls. The following must be met: A. CO2 sensors installed in each room served by systems with DCV controls B. CO2 sensors are located between 3 ft and 6 ft above the floor C. CO2 concentrations maintained at less than or equal to 600 ppm plus outdoor ppm D. During hours of expected occupancy, controls maintain the system ventilation rate.			N/A			
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**ALL HVAC SYSTEMS - ECONOMIZERS**

140.4(e)1 and 3	Each cooling fan system that has a design mechanical cooling capacity over 54,000 Btu/h has an air economizer or a water economizer. Air economizers must comply with the high limit shutoff controls shown in Table 140.4-B.						
140.4(e)2.B	Plans indicate integrated economizer controls are set up such that partial cooling is provided by the economizer even when additional mechanical cooling is required.						
<i>Best Practice</i>	<i>Economizer dampers are specified to be driven by direct drive actuators rather than rod linkages, which can be a major cause of economizer malfunction.</i>						
<i>Best Practice</i>	<i>Barometric relief is used, if possible. If not, relief fans (rather than return fans) are used in most cases.</i>						
<i>Best Practice</i>	<i>Outdoor and return air sensors are properly selected, properly located to provide accurate and repeatable measurements for controlling economizer operation. Averaging sensors cover the entire duct or coil face areas.</i>						

**DUCT DESIGN**

120.4(a)	All air distribution system ducts and plenums must be installed, sealed and insulated as required by 120.4(a).						
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140.4(l)	Plans indicate duct sealing leakage rates.						
Best Practice	<i>Ducts utilize low static pressure design. Identify the most restrictive branch from the fan to the last air terminal unit. Identify possible means of significantly reducing the pressure drop. Branch duct systems are designed for equal pressure drop, when possible.</i>						
Best Practice	<i>Duct branches with significantly differing static pressure requirements have volume control strategically placed to aid in TAB work.</i>						
Best Practice	<i>Fans discharge into duct sections that remain straight for as long as possible (ideally 10 duct diameters) to reduce fan inefficiencies from system effects.</i>						
Best Practice	<i>Duct velocities are generally below 2,000 fpm for ducts in ceiling plenums, 1500 fpm for exposed ducts and 3500 fpm in mechanical rooms and non-noise sensitive shafts.</i>						
Best Practice	<i>Duct friction rates are generally less than 0.25" WC per 100 lineal feet nearer the fan, 0.15 to 0.20" in the main ducts and 0.08 to 0.12" WC /100' nearer the end of the system. Designs over these rates should be questioned. Very energy efficient design can lower these values by up to 40%.</i>						
Best Practice	<i>Ensure that drawings are sufficiently detailed to ensure that distribution system design intent is adequately conveyed. If sufficient detail is not included in drawings, installations may result in significantly higher pressure drops and hence higher energy consumption and other operating issues.</i>						

**ACCEPTANCE AND COMMISSIONING**

120.5(a)	Acceptance requirements clearly identified in construction documents.			N/A			
120.8(e)	Commissioning measures or requirements are reflected in the construction documents.			N/A			
120.8(g)	Requirements for functional performance tests are reflected in the construction documents.			N/A			

**NOTES**



CERTIFICATE OF COMPLIANCE		NRCC-CXR-03-E
Construction Documents		(Page 1 of 1)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>	

## General Information

Climate Zone: <b>12</b>	Building Type: <b>New Construction</b>	Conditioned Area (sf): <b>2,500 ft<sup>2</sup></b>
Reviewer's Name: <b>Ms. Design Reviewer</b>	Reviewer's Agency: <b>Best Energy Comp.</b>	
<i>Note: Design Review for each system/subsystem must be submitted</i>		
Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>	
Enforcement Agency Use: Checked by	Enforcement Agency Use: Date	

Code Section	Measure	Design Reviewer			Designer Response		
		Yes. Complies	Does Not Comply	Consider Better Practice	Complies	Will Include in Next Draft	Not Included - State Reason
<b>SIMPLE HVAC SYSTEMS</b>							
<b>DESIGN - FAN SYSTEMS</b>							
120.1(e)	Measured outdoor air rates of constant volume mechanical ventilation and space-conditioning systems shall be within 10% of required outside air rate.	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
140.4(c)1	Fan power index at design conditions meets the following: 0.8 watts per cfm supply air for constant volume fan systems with total horsepower over 25 hp	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
<i>Best Practices</i>	<i>Fans appear to be correctly sized for application, accounting for a factor of safety, diversity and redundancy issues.</i>			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
<b>CONTROLS</b>							
110.2(c)	Controls for unitary single zone, air conditioners, heat pumps and furnaces must have a setback thermostat.	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
140.4(m)	Cooling systems identified in Table 140.4-D have fan controls to vary the indoor fan airflow as a function of load: 1. DX and chilled water cooling systems that control capacity based on occupied space temperature have a minimum of 2 stages of control with no more than 66% speed operating at stage 1 and draw no more than 40% of fan power at full fan speed when operating at 66% speed. 2. Systems that control space temperature by modulating airflow to the space have proportional fan control such that at 50% air flow the power draw is no more than 30% of fan power at full fan speed. 3. Systems with air side economizer have a minimum of 2 speeds of fan control during economizer operation.	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
<b>NOTES</b>							



# Lighting – Multi-Level

## 2008 – §131(b)

- Multi-level lighting controls req. for:
  - Enclosed spaces  $\geq 100$  ft<sup>2</sup>; and
  - Have a lighting load  $> 0.8$  W/ft<sup>2</sup>
- One control step between 30% and 70%
- Uniform illuminance with dimmers, A/B switching, etc.

## 2013 – §130.1(b)

- Multi-level lighting controls req. for
  - Enclosed space  $\geq 100$  ft<sup>2</sup>; and
  - Have a lighting load  $> 0.5$  W/ft<sup>2</sup>
- Control steps and uniform illuminance dependent on luminaire type
  - In accordance with [TABLE 130.1-A](#)

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

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



# Lighting – Shut-OFF

## 2008 – §131(d)

- Shut-off controls req. for every floor
- Can be achieved with:
  - Occupancy sensors
  - Automatic time-switch
  - Countdown timer switch
  - Etc.

## 2013 – §130.1(c)

- Countdown time switches prohibited (some exceptions)
- Occupant sensors that shut off all lighting req. in specific areas
- Occupant sensors with partial ON/OFF controls req. in specific areas
- Captive key cards req. in hotel/motel guest rooms

- B. Lumen maintenance as defined in Section 100.1
- C. Tuning as defined in Section 100.1
- D. Automatic daylighting controls in accordance with Section 130.1(d)
- E. Demand responsive lighting controls in accordance with Section 130.1(e)

**EXCEPTION 1 to Section 130.1(b):** Classrooms, with a connected general lighting load of 0.7 watts per square feet and less, shall have at least one control step between 30-70 percent of full rated power.

**EXCEPTION 2 to Section 130.1(b):** An area enclosed by ceiling height partitions that has only one luminaire with no more than two lamps.

**(c) Shut-OFF Controls**

1. In addition to lighting controls installed to comply with Sections 130.1(a) and (b), all installed indoor lighting shall be equipped with controls that meet the following requirements:
  - A. Shall be controlled with an occupant sensing control, automatic time-switch control, signal from another building system, or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and
  - B. Separate controls for the lighting on each floor; and
  - C. Separate controls for a space enclosed by ceiling height partitions not exceeding 5,000 square feet; and
 

**EXCEPTION to Section 130.1(c)1C:** In the following function areas the area controlled may not exceed 20,000 square feet: Malls, auditoriums, single tenant retail, industrial, convention centers, and arenas,
  - D. Separate controls for general, display, ornamental, and display case lighting.

**EXCEPTION 1 to Section 130.1(c)1:** Where the lighting is serving an area that is in continuous use, 24 hours per day/365 days per year.

**EXCEPTION 2 to Section 130.1(c)1:** Lighting complying with Section 130.1(c)5, or 7.

**EXCEPTION 3 to Section 130.1(c)1:** In office buildings, up to 0.05 watts per square foot of lighting in any area within a building may be continuously illuminated, provided that the area is designated an emergency egress area on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1.

**EXCEPTION 4 to Section 130.1(c)1:** Electrical equipment rooms subject to Article 110.26(D) of the California Electric Code.

2. Countdown timer switches shall not be used to comply with the automatic shut-OFF control requirements in Section 130.1(c)1.

**EXCEPTION 1 to Section 130.1(c)2:** Single-stall bathrooms less than 70 square feet, and closets less than 70 square feet may use countdown timer switches with a maximum setting capability of ten minutes to comply with the automatic shut-Off requirements.

**EXCEPTION 2 to Section 130.1(c)2:** Lighting in a Server Aisle in a Server Room, as defined in Section 100.1, may use countdown timer switches with a maximum setting capability of 30 minutes to comply with the automatic shut-OFF requirements.

3. If an automatic time-switch control, other than an occupant sensing control, is installed to comply with Section 130.1(c)1, it shall incorporate an override lighting control that:
  - A. Complies with Section 130.1(a); and
  - B. Allows the lighting to remain ON for no more than 2 hours when an override is initiated.

**EXCEPTION to Section 130.1(c)3B:** In the following function areas, the override time may exceed 2 hours: Malls, auditoriums, single tenant retail, industrial, and arenas where captive-key override is utilized.

4. If an automatic time-switch control, other than an occupant sensing control, is installed to comply with Section 130.1(c)1, it shall incorporate an automatic holiday "shut-OFF" feature that turns OFF all loads for at least 24 hours, and then resumes the normally scheduled operation.

**EXCEPTION to Section 130.1(c)4:** In retail stores and associated malls, restaurants, grocery stores, churches, and theaters, the automatic time-switch control is not required to incorporate an automatic holiday shut-OFF feature.

5. **Areas where Occupant Sensing Controls are required to shut OFF All Lighting.** In offices 250 square feet or smaller, multipurpose rooms of less than 1,000 square feet, classrooms of any size, and conference rooms of any size, lighting shall be controlled with occupant sensing controls to automatically shut OFF all of the lighting when the room is unoccupied. In addition, controls shall be provided that allow the lights to be manually shut-OFF in accordance with Section 130.1(a) regardless of the sensor status.

6. **Areas where partial ON/OFF occupant sensing controls are required in addition to complying with Section 130.1(c)1.**

- A. In aisle ways and open areas in warehouses, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls shall independently control lighting in each aisle way, and shall not control lighting beyond the aisle way being controlled by the sensor.

**EXCEPTION 1 to Section 130.1(c)6A:** 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, occupant sensing controls shall reduce lighting power by at least 40 percent.

**EXCEPTION 2 to Section 130.1(c)6A:** When metal halide lighting or high pressure sodium lighting is installed in warehouses, occupant sensing controls shall reduce lighting power by at least 40 percent.

- B. In library book stack aisles 10 feet or longer that are accessible from only one end, and library book stack aisles 20 feet or longer that are accessible from both ends, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls shall independently control lighting in each aisle way, and shall not control lighting beyond the aisle way being controlled by the sensor.
  - C. Lighting installed in corridors and stairwells shall be controlled by occupant sensing controls that separately reduce the lighting power in each space by at least 50 percent when the space is unoccupied. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.
7. **Areas where partial ON/OFF occupant sensing controls are required** instead of complying with Section 130.1(c)1.
    - A. Lighting in stairwells and common area corridors that provide access to guestrooms and dwelling units of high-rise residential buildings and hotel/motels shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.

**EXCEPTION to Section 130.1(c)7A:** In corridors and stairwells in which the installed lighting power is 80 percent or less of the value allowed under the Area Category Method, occupant sensing controls shall reduce power by at least 40 percent.
    - B. In parking garages, parking areas and loading and unloading areas, general lighting shall be controlled by occupant sensing controls having at least one control step between 20 percent and 50 percent of design lighting power. No more than 500 watts of rated lighting power shall be controlled together as a single zone. A reasonably uniform level of illuminance shall be achieved in accordance with the applicable requirements in TABLE 130.1-A. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.

Interior areas of parking garages are classified as indoor lighting for compliance with Section 130.1(c)7B. Parking areas on the roof of a parking structure are classified as outdoor hardscape and shall comply with the applicable provisions in Section 130.2.

**EXCEPTION to Section 130.1(c)7B:** Metal halide luminaires with a lamp plus ballast mean system efficacy of greater than 75 lumens per watt, used for general lighting in parking garages, parking areas and loading and unloading areas, shall be controlled by occupant sensing controls having at least one control step between 20 percent and 60 percent of design lighting power.

8. Hotel motel guest rooms shall have captive card key controls, occupancy sensing controls, or automatic controls such that, no longer than 30 minutes after the guest room has been vacated, lighting power is switched off.

**EXCEPTION to Section 130.1(c)8:** One high efficacy luminaire as defined in TABLE 150.0-A or 150.0-B that is switched separately and where the switch is located within 6 feet of the entry door.

(d) **Automatic Daylighting Controls.**

1. Daylit Zones shall be defined as follows:

- A. **SKYLIT DAYLIT ZONE** is the rough area in plan view under each skylight, plus 0.7 times the average ceiling height in each direction from the edge of the rough opening of the skylight, minus any area on a plan beyond a permanent obstruction that is taller than the following: A permanent obstruction that is taller than one-half the distance from the floor to the bottom of the skylight. The bottom of the skylight is measured from the bottom of the skylight well for skylights having wells, or the bottom of the skylight if no skylight well exists.

For the purpose of determining the skylit daylit zone, the geometric shape of the skylit daylit zone shall be identical to the plan view geometric shape of the rough opening of the skylight; for example, for a rectangular skylight the skylit daylit zone plan area shall be rectangular, and for a circular skylight the skylit daylit zone plan area shall be circular.

- B. **PRIMARY SIDELIT DAYLIT ZONE** is the area on a plan directly adjacent to each vertical glazing, one window head height deep into the area, and window width plus 0.5 times window head height wide on each side of the rough opening of the window, minus any area on a plan beyond a permanent obstruction that is 6 feet or taller as measured from the floor.
- C. **SECONDARY SIDELIT DAYLIT ZONE** is the area on a plan directly adjacent to each vertical glazing, two window head heights deep into the area, and window width plus 0.5 times window head height wide on each side of the rough opening of the window, minus any area on a plan beyond a permanent obstruction that is 6 feet or taller as measured from the floor.

**Note:** Modular furniture walls shall not be considered a permanent obstruction.

2. Luminaires providing general lighting that are in or are partially in the Skylit Daylit Zones or the Primary Sidelit Daylit Zones shall be controlled independently by fully functional automatic daylighting controls that meet the applicable requirements of Section 110.9, and the applicable requirements below:
- A. All Skylit Daylit Zones and Primary Sidelit Daylit Zones shall be shown on the plans.
- B. Luminaires in the Skylit Daylit Zone shall be controlled separately from those in the Primary Sidelit Daylit Zones.
- C. Luminaires that fall in both a Skylit and Primary Sidelit Daylit Zone shall be controlled as part of the Skylit Daylit Zone.
- D. **Automatic Daylighting Control Installation and Operation.** For luminaires in daylight zones, automatic daylighting controls shall be installed and configured to operate according to all of the following requirements:
- i. Photosensors shall be located so that they are not readily accessible to unauthorized personnel, and the location where calibration adjustments are made to automatic daylighting controls shall not be readily accessible to unauthorized personnel.



# Lighting – Acceptance/Installation Cert.

## 2008 – §134

- Testing mandatory if controls/systems installed for:
  - Multi-level controls
  - Shut-off controls
  - Daylighting controls
  - Automatic daylighting controls
- Identified as “LTG-A”

## 2013 – §130.4

- Identified as “NRCA-LTI”
  - Must be performed by Certified Lighting Controls Acceptance Test Technician (CLCATT)
- New Certificate(s) of Installation req.
  - Identified as “NRCI-LTI”
  - Completed by installing contractor

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## SECTION 130.4 –LIGHTING CONTROL ACCEPTANCE AND INSTALLATION CERTIFICATE REQUIREMENTS

- (a) **Lighting Control Acceptance Requirements.** Before an occupancy permit is granted for a newly constructed building or area, or a new lighting system serving a building, area, or site is operated for normal use, indoor and outdoor lighting controls serving the building, area, or site shall be certified as meeting the Acceptance Requirements for Code Compliance in accordance with Section 130.4. A Certificate of Acceptance shall be submitted to the enforcement agency under Section 10-103(a) of Part 1, that:
1. Certifies plans, specifications, installation certificates, and operating and maintenance information meet the requirements of Part 6.
  2. Completes the applicable procedures in Reference Nonresidential Appendix NA7.6, NA7.7, NA7.8, and NA7.9; and submits all applicable compliance forms.
  3. Certifies that automatic daylight controls comply with Section 130.1(d) and Reference Nonresidential Appendix NA7.6.1
  4. Certifies that lighting shut-OFF controls comply with Section 130.1(c) and Reference Nonresidential Appendix NA7.6.2
  5. Certifies that demand responsive controls comply with Section 130.1(e) and Reference Nonresidential Appendix NA7.6.3
  6. Certifies that outdoor lighting controls comply with the applicable requirements of Section 130.2(c) and Reference Nonresidential Appendix NA7.8.
- (b) **Lighting Control Installation Certificate Requirements.** To be recognized for compliance with Part 6 an Installation Certificate shall be submitted in accordance with Section 10-103(a) for any lighting control system, Energy Management Control System, track lighting integral current limiter, track lighting supplementary overcurrent protection panel, interlocked lighting system, lighting Power Adjustment Factor, or additional wattage available for a videoconference studio, in accordance with the following requirements, as applicable:
1. Certification that when a lighting control system is installed to comply with lighting control requirements in Part 6 it complies with the applicable requirements of Section 110.9; and complies with Reference Nonresidential Appendix NA7.7.1.
  2. Certification that when an Energy Management Control System is installed to function as a lighting control required by Part 6 it functionally meets all applicable requirements for each application for which it is installed, in accordance with Sections 110.9, 130.0 through 130.5, 140.6 through 150.0, and 150.2; and complies with Reference Nonresidential Appendix NA7.7.2.
  3. Certification that line-voltage track lighting integral current limiters comply with the applicable requirements of Section 110.9 and installed wattage has been determined in accordance with Section 130.0(c); and comply with Reference Nonresidential Appendix NA7.7.3.
  4. Certification that line-voltage track lighting supplementary overcurrent protection panels comply with the applicable requirements of Section 110.9 and installed wattage has been determined in accordance with Section 130.0(c); and comply with Reference Nonresidential Appendix NA7.7.4.
  5. Certification that interlocked lighting systems used to serve an approved area comply with Section 140.6(a)1; and comply with Reference Nonresidential Appendix NA7.7.5.
  6. Certification that lighting controls installed to earn a lighting Power Adjustment Factor (PAF) comply with Section 140.6(a)2; and comply with Reference Nonresidential Appendix NA7.7.6.
  7. Certification that additional lighting wattage installed for a videoconference studio complies with Section 140.6(c)2Gvii; and complies with Reference Nonresidential Appendix NA7.7.7.

- (c) When certification is required by Title 24, Part 1, Section 10-103-A, the acceptance testing specified by Section 130.4 shall be performed by a Certified Lighting Controls Acceptance Test Technician (CLCATT). If the CLCATT is operating as an employee, the CLCATT shall be employed by a Certified Lighting Controls Acceptance Test Employer. The CLCATT shall disclose on the Certificate of Acceptance a valid CLCATT certification identification number issued by an approved Acceptance Test Technician Certification Provider. The CLCATT shall complete all Certificate of Acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

**NOTE:** Authority cited: Sections 25402, 25402.1, 25213, Public Resources Code. Reference: Sections 25007, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8 and 25910, Public Resources Code.

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## SECTION 130.5 –ELECTRICAL POWER DISTRIBUTION SYSTEMS

- (a) **Service Metering.** Each electrical service shall have permanently installed user-accessible metering of total electrical energy use per TABLE 130.5-A.
- (b) **Disaggregation of Electrical Circuits.** Electrical power distribution systems shall be designed to permit the disaggregated measurement of electrical load energy uses downstream from the service meter according to TABLE 130.5-B. Additive and subtractive methods may be used to determine aggregate and disaggregated energy use. This may be accomplished by any of the following methods:
1. Separate switchboards, motor control centers, or panelboards to which are connected only the required load or group of loads; or
  2. Subpanels of the above to which are connected only the required load or group of loads and for which the subpanel load can be independently measured in aggregate; or
  3. Branch circuits, taps or disconnects requiring overcurrent protection devices rated 60 amperes or greater.

**EXCEPTION to Section 130.5(a)** Buildings for which the utility company provides a meter for occupant or user use that indicates instantaneous kW demand and kWh for a user-resettable period.

**EXCEPTION to Section 130.5(a)** Buildings for which the utility company provides a meter for occupant or user use that indicates instantaneous kW demand and kWh for a user-resettable period.

**EXCEPTION 1 to Section 130.5(b)** Buildings for which a complete metering and measurement system is provided that at a minimum measures and reports the loads called for in TABLE 130.5-B.

**EXCEPTION 2 to Section 130.5(b)** Alterations where all of the following conditions exist are not required to comply with this section:

- A. The following existing equipment remains in place:
- i. Service distribution switchboards or panelboards; and
  - ii. Feeders; and
  - iii. Motor control centers or panelboards.
- B. Existing equipment included in Item A (above) remains unaltered except for:
- i. Changes to load circuit connections; or
  - ii. Changes to the quantity of outgoing overcurrent protection devices; or
  - iii. Changes to the ampacity of outgoing overcurrent protection devices.

(c) **Voltage Drop**

1. **Feeders.** Feeder conductors shall be sized for a maximum voltage drop of 2 percent at design load.
2. **Branch Circuits.** Branch circuit conductors shall be sized for a maximum voltage drop of 3 percent at design load.

**EXCEPTION to Section 130.5(c):** Feeder conductors and branch circuits that are dedicated to emergency services.



# Lighting – Installation Cert. *cont.*

- **Certificate of Installation required for ([NRCC-LTI-01](#)):**
  - EMCS or lighting control system ([NRCI-LTI-02](#))
  - Track lighting current limiter or supplementary overcurrent protection panel ([NRCI-LTI-03](#))
  - Two interlocked lighting systems ([NRCI-LTI-04](#))
  - Power Adjustment Factors ([NRCI-LTI-05](#))
  - Videoconference studio lighting ([NRCI-LTI-06](#))
- **All forms must be registered starting 1/1/15**

**INDOOR LIGHTING**

CEC-NRCC-LTI-01-E (Revised 06/13)

**CERTIFICATE OF COMPLIANCE – USER INSTRUCTIONS**

NRCC-LTI-01-E

Indoor Lighting

(Page 2 of 5)

Project Name: **2013 CALBO Training Sample**

Date Prepared:

**01/01/14**

5.	Complies ONLY if <b>Installed ≤ Allowed</b>		Complies ONLY if <b>Installed ≤ Allowed</b>	
6.	<b>Allowed</b> Lighting Power Conditioned NRCC-LTI-03-E, page 1		<b>Allowed</b> Lighting Power Unconditioned NRCC-LTI-03-E, page 1	

**Declaration of Required Installation Certificates** – Declare by selecting yes for all Installation Certificates that will be submitted. (Retain copies and verify forms are completed and signed.)

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

**Declaration of Required Certificates of Acceptance** – Declare by checking all of the Certificates of Acceptance that will be submitted. (Retain copies and verify forms are completed and signed.)

YES	NO	Form/Title	
<input checked="" type="checkbox"/>		NRCA-LTI-02-E - Must be submitted for occupancy sensors and automatic time switch controls.	<input type="checkbox"/> Field Inspector
<input checked="" type="checkbox"/>		NRCA-LTI-03-E - Must be submitted for automatic daylight controls.	<input type="checkbox"/> Field Inspector
	<input checked="" type="checkbox"/>	NRCA-LTI-04-E - Must be submitted for demand responsive lighting controls.	<input type="checkbox"/> Field Inspector

**TWO INTERLOCKED LIGHTING SYSTEMS**

CEC-NRCI-LTI-04-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF INSTALLATION		NRCI-LTI-04-E
Two Interlocked Lighting Systems		(Page 1 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

GENERAL INFORMATION				
DATE OF BUILDING PERMIT		PERMIT #		
BUILDING TYPE	<input checked="" type="checkbox"/> Nonresidential	<input type="checkbox"/> High-Rise Res (Common Area)	<input type="checkbox"/> Hotel/Motel (Common Area)	
PHASE OF CONSTRUCTION	<input checked="" type="checkbox"/> New Construction	<input type="checkbox"/> Addition	<input type="checkbox"/> Alteration	<input type="checkbox"/> Unconditioned

SCOPE OF RESPONSIBILITY	
<i>Enter the date of approval by enforcement agency of the Certificate of Compliance that provides the specifications for the energy efficiency measures for the scope of responsibility for this Installation Certificate.</i>	Date: <b>01/01/14</b>

**Two Interlocked Lighting Systems**

§130.4(b) - Before Two Interlocked Lighting Systems will be permitted for compliance with §140.6 of Part 6 of Title 24, the person who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the construction or installation of features, materials, components, or manufactured devices shall sign and submit this Installation Certificate.

§140.6(a)1. Two interlocked lighting systems: No more than two lighting systems may be used for an area, and if there are two they must be interlocked. Where there are two interlocked lighting systems, the watts of the lower wattage system may be excluded from the actual indoor Lighting Power Density if:

- A. An Installation Certificate detailing compliance with §140.6(a)1 is submitted in accordance with §10-103 and §130.4; and
- B. The area or areas served by the interlocking systems is an auditorium, a convention center, a conference room, a multipurpose room, or a theater; and
- C. The two lighting systems are interlocked with a Nonprogrammable Double-Throw Switch to prevent simultaneous operation of both systems.

If any of the following requirements fail, all installed and all planned portable lighting in the function area shall be included in the Certificates of Compliance when determining the installed lighting power.

**Check all that apply:**

- The function area qualifies to install two interlocked lighting systems because it is **ONLY** one of the following types:
- Auditorium room
  - Convention center room
  - Conference room
  - Multipurpose room
  - Theater room
- There are no more than two interlocked lighting systems serving the space.
- The two lighting systems are interlocked with a non-programmable double throw switch to prevent simultaneous operation.

For compliance with Part 6, a Nonprogrammable Double-Throw Switch is an electrical switch commonly called a "single pole double throw" or "three-way" switch that is wired as a selector switch allowing one of two loads to be enabled. It can be a line voltage switch or a low voltage switch selecting between two



CERTIFICATE OF INSTALLATION		NRCI-LTI-05-H
Power Adjustment Factors		(Page 1 of 5)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

GENERAL INFORMATION				
DATE OF BUILDING PERMIT	PERMIT #			
BUILDING TYPE	<input type="checkbox"/> Nonresidential	<input type="checkbox"/> High-Rise Res (Common Area)	<input type="checkbox"/> Hotel/Motel (Common Area)	
PHASE OF CONSTRUCTION	<input type="checkbox"/> New Construction	<input type="checkbox"/> Addition	<input type="checkbox"/> Alteration	<input type="checkbox"/> Unconditioned

SCOPE OF RESPONSIBILITY	
Enter the date of approval by enforcement agency of the Certificate of Compliance that provides the specifications for the energy efficiency measures for the scope of responsibility for this Installation Certificate:	Date:

**Power Adjustment Factor (PAF)**

§130.4(b) - Before a Power Adjustment Factor will be allowed for compliance with Section 140.6 of Part 6 of Title 24, the person who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the construction or installation of features, materials, components, or manufactured devices shall sign and submit this Installation Certificate.

§140.6(a) 2 - Reduction of wattage through controls. In calculating actual indoor Lighting Power Density, the installed watts of a luminaire providing general lighting in an area listed in TABLE 140.6-A may be reduced by the product of (i) the number of watts controlled as described in TABLE 140.6-A, times (ii) the applicable Power Adjustment Factor (PAF), if all of the conditions [in this Certificate of Installation are met]:

If any of the requirements in this Installation Certificate fail, the installation shall not be eligible for using the PAF.

**Check all that apply:****PART 1 Certificate Of Compliance Correctly Filled Out**

- In addition to this Certificate of Installation, the PAF has been correctly document on page 2 of NRCC-LTI-02—E of the Certificate of Compliance submitted to the building department.

**PART 2 Type of PAF** **A. This installation qualifies for the following PAFs:**

1. This installation qualifies for the PAF for a Partial-ON Occupant Sensing Control in TABLE 140.6-A because it meets all of the following requirements:
- a. The Partial-ON Occupant Sensing Control is use in only the following space types:
    - i, An area  $\leq$  250 square feet enclosed by floor-to-ceiling partitions
    - ii. A classroom of any size
    - iii. A conference room of any size
    - iv. A waiting room of any size
  - b. The PAF used is 0.20
  - c. The control automatically deactivates all of the lighting power in the area within 30 minutes after the room has been vacated; and
  - d. The first stage automatically activates between 30-70 percent of the lighting power in the area
  - e. The lighting control is a:
    - i. Switching system, or



CERTIFICATE OF INSTALLATION		NRCI-LTI-05-H
Power Adjustment Factors		(Page 2 of 5)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

- ii. Dimming system; and
  - f. The second stage manually activates the alternate set of lights; and
  - g. This manual-ON function is not capable of conversion from manual-ON to automatic-ON functionality via manual switches or dip switches; and
  - h. Switches are located in accordance with Section 130.1(a)
  - i. Occupants can manually do all of the following regardless of the sensor status:
    - Activate the alternate set of lights; and
    - Activate 100 percent of the lighting power; and
    - Deactivate all of the lights.
2. This installation qualifies for the PAF for an occupant sensing control controlling the general lighting in large open plan office areas above workstations, in accordance with TABLE 140.6-A, because the following requirements have been met:
- a. The occupant sensing controls are in large open plan offices that are greater than 250 square feet and:
    - i. One sensor is controlling an area that is no larger than 125 square feet, and the PAF used in 0.40
    - ii. One sensor is controlling an area that is from 126 to 250 square feet, and the PAF used in 0.30
    - iii. One sensor is controlling an area that is from 251 to 500 square feet, and the PAF used in 0.20
  - b. This PAF is only being applied only to office areas which contain workstations; and
  - c. Controlled luminaires are only those which provide general lighting directly above the controlled area, or furniture mounted luminaires that comply with Section 140.6(a)2 and provide general lighting directly above the controlled area; and
  - d. Qualifying luminaires have been controlled by occupant sensing controls that meet all of the following requirements, as applicable:
    - i. Infra-red sensors have been equipped by the manufacturer, or fitted in the field by the installer, with lenses or shrouds to prevent them from being triggered by movement outside of the controlled area.
    - ii. Ultrasonic sensors have been tuned to reduce their sensitivity to prevent them from being triggered by movements outside of the controlled area.
    - iii. All other sensors have been installed and adjusted as necessary to prevent them from being triggered by movements outside of the controlled area.
3. This installation qualifies for the PAF for a Manual Dimming System or a Multiscene Programmable Dimming System in TABLE 140.6-A because:
- a. The lighting is controlled with a control that can be manually operated by the user; and
  - b. The space is only of the following type:
    - i. Hotel/motel
    - ii. Restaurant
    - iii. Auditorium
    - iv. Theater
  - c. The type of control and PAF used is one of the following:
    - i. A Dimming System with manual dimming and the PAF used is 0.10



CERTIFICATE OF INSTALLATION		NRCI-LTI-05-H
Power Adjustment Factors		(Page 3 of 5)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

- ii. A Multiscene Programmable control and the PAF used is 0.20
4. This installation qualifies for the PAF for a Demand Responsive Control in TABLE 140.6-A, because the installation meets all of the following requirements:
- i. The building is 10,000 square feet or smaller; and
  - ii. The PAF used is 0.05. Note that luminaires that qualify for other PAFs may also qualify for this demand responsive control PAF.
  - iii. The controlled lighting is capable of being automatically reduced in response to a demand response signal; and
  - iv. Lighting has been reduced in a manner consistent with uniform level of illumination requirements in TABLE 130.1-A; and
  - v. Spaces that are non-habitable have not been used to comply with this requirement, and
  - v. Spaces with a lighting power density of less than 0.5 watts per square foot have not been counted toward the building's total lighting power.
5. This installation qualifies for the PAF for Combined Manual Dimming plus Partial-ON Occupant Sensing Control in TABLE 140.6-A because the installation meets all of the following requirements:
- a. The Combined Control is use in only the following space types:
    - i, An area  $\leq$  250 square feet enclosed by floor-to-ceiling partitions
    - ii. A classroom of any size
    - iii. A conference room of any size
    - iv. A waiting room of any size
  - b. The lighting is controlled with a control that can be manually operated by the user; and
  - c. The dimming component is one of the following:
    - i. A Dimming System with manual dimming; or
    - ii. A Multiscene Programmable control
  - d. The Partial-ON Occupant Sensing component automatically deactivates all of the lighting power in the area within 30 minutes after the room has been vacated; and
    - i. The first stage automatically activates between 30-70 percent of the lighting power in the area
    - ii. The lighting control is a:
      - Switching system, or
      - Dimming system; and
    - iii. The second stage manually activates the alternate set of lights; and
    - iv. This manual-ON function is not capable of conversion from manual-ON to automatic-ON functionality via manual switches or dip switches; and
    - v. Switches are located in accordance with Section 130.1(a)
    - vi. Occupants can manually do all of the following regardless of the sensor status:
      - Activate the alternate set of lights; and
      - Activate 100 percent of the lighting power; and
      - Deactivate all of the lights.
  - e. The PAF used is 0.25

### **PART 3 PAF Minimum Requirements**

***Check all that apply:***



CERTIFICATE OF INSTALLATION		NRCI-LTI-05-H
Power Adjustment Factors		(Page 4 of 5)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

- A. The lighting control used to earn the PAF is designed and installed in addition to all manual, and automatic lighting controls otherwise required in 130.1(a) through (e)
- EXCEPTION. The lighting control used to earn a PAF has been designed and installed for the sole purpose of compliance with Section 130.1(b)3, and this lighting control is designed and installed in addition to all other manual, and automatic lighting controls otherwise required in Section 130.1.
- B. Installed wattage has been determined in accordance with Section 130.0(c)
- C. Space types that qualify for the PAF comply with the definition for that space type in Section 100.1(b)
- D. Self contained lighting controls used to earn the PAF comply with Section 110.9 and are certified in accordance with the Appliance Efficiency Regulations, as verified on the Title 20 database of certified lighting controls
- E. A lighting control system is used to earn the PAF, which complies with Section 110.9.
- When using a lighting control system to earn a PAF, also submit the Installation Certificate for Energy Management Control System and Lighting Control System
- F. The controls are permanently installed nonresidential-rated lighting controls. (Portable lighting, portable lighting controls, and residential rated lighting controls shall not qualify for PAFs.)
- G. The controlled lighting used to earn this PAF is a permanently installed general lighting system.
- Furniture mounted luminaires qualify as general lighting system for the purpose of earning this PAF because the general lighting is in an office, and the furniture mounted luminaires comply with all of the following conditions:
- i. The furniture mounted luminaires have been permanently installed no later than the time of building permit inspection; and
- ii. The furniture mounted luminaires have been permanently hardwired; and
- iii. The furniture mounted lighting system has been designed to provide indirect general lighting; and
- iv. Before multiplying the installed watts of the furniture mounted luminaire by the applicable PAF, 0.3 watts per square foot of the area illuminated by the furniture mounted luminaires has been subtracted from installed watts of the furniture mounted luminaires; and
- H. At least 50 percent of the light output of the controlled luminaire is within the applicable area listed in TABLE 140.6-A. Luminaires on lighting tracks are within the applicable area in order to qualify for a PAF.
- I. Only one PAF from TABLE 140.6-A has been used for each qualifying luminaire. PAFs have not been added together unless specifically allowed in TABLE 140.6-A.
- L. Only lighting wattage directly controlled in accordance with Section 140.6(a)2 has been used to reduce the calculated actual indoor Lighting Power Densities as allowed by Section 140.6(a)2.
- Only a portion of the wattage in a luminaire is controlled in accordance Section 140.6(a)2, and only that portion of controlled wattage has been reduced in calculating actual indoor Lighting Power Density.

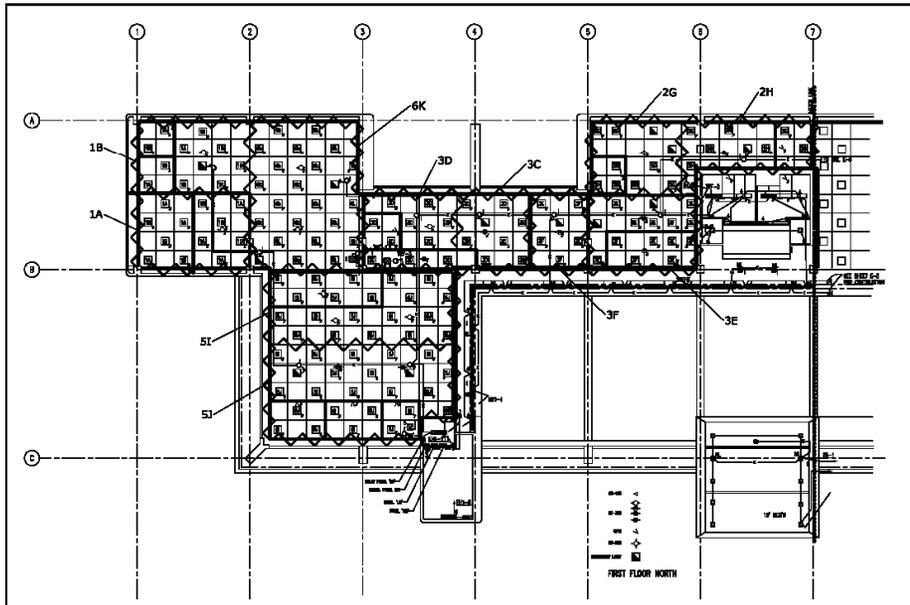


# §130.1, §130.4 and the Plans Examiner

- **Still verify multi-level and shut-OFF controls on electrical plans:**

- More spaces may req. multi-level controls ( $> 0.5 \text{ W/ft}^2$ )
- Many spaces will req. occupant sensors
  - All lighting
  - Partial ON/OFF

- Refer to [NRCC-LTI-02](#) as mandatory note block



**INDOOR LIGHTING – LIGHTING CONTROLS**

CEC-NRCC-LTI-02-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE		NRCC-LTI-02-E
Indoor Lighting - Lighting Controls		(Page 1 of 5)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>	

The NRCC-LTI-02-E shall be used to document all mandatory and prescriptive lighting controls that are applicable to the project.

<b>A. Mandatory Lighting Control Declaration Statements</b>		
Indicate if the measure applies:		
YES	NO	Control Requirements
<input checked="" type="checkbox"/>		Lighting shall be controlled by self-contained lighting control devices which are certified to the Energy Commission according to the Title 20 Appliance Efficiency Regulations in accordance with Section 110.9.
	<input checked="" type="checkbox"/>	Lighting shall be controlled by a lighting control a system or energy management control system in accordance with §110.9. An Installation Certificate shall be submitted in accordance with Section 130.4(b).
<input checked="" type="checkbox"/>		One or more Track Lighting Integral Current Limiters shall be installed which have been certified to the Energy Commission in accordance with §110.9 and §130.0. An Installation Certificate shall be submitted in accordance with Section 130.4(b).
	<input checked="" type="checkbox"/>	A Track Lighting Supplementary Overcurrent Protection Panel shall be installed in accordance with Section 110.9 and Section 130.3. Additionally, an Installation Certificate shall be installed in accordance with Section 130.4(b).
<input checked="" type="checkbox"/>		All lighting controls and equipment shall comply with the applicable requirements in §110.9 and shall be installed in accordance with the manufacturer's instructions in accordance with Section 130.1.
<input checked="" type="checkbox"/>		All luminaires shall be functionally controlled with manually switched ON and OFF lighting controls in accordance with Section 130.1(a).
<input checked="" type="checkbox"/>		General lighting shall be separately controlled from all other lighting systems in an area. Floor and wall display, window display, case display, ornamental, and special effects lighting shall each be separately controlled on circuits that are 20 amps or less. When track lighting is used, general, display, ornamental, and special effects lighting shall each be separately controlled; in accordance with Section 130.0(a)4.
<input checked="" type="checkbox"/>		The general lighting of any enclosed area 100 square feet or larger, with a connected lighting load that exceeds 0.5 watts per square foot shall meet the multi-level lighting control requirements in accordance with Section 130.1(b).
<input checked="" type="checkbox"/>		All installed indoor lighting shall be equipped with controls that meet the applicable Shut-OFF control requirements in Section 130.1(c).
	<input checked="" type="checkbox"/>	Lighting in all Daylit Zones shall be controlled in accordance with the requirements in Section 130.1(d) and daylit zones are shown on the plans.
	<input checked="" type="checkbox"/>	Lighting power in buildings larger than 10,000 square feet shall be capable of being automatically reduced in response to a Demand Responsive Signal in accordance with Section 130.1(e).

# INDOOR LIGHTING – LIGHTING CONTROLS

CEC-NRCC-LTI-02-E (Revised 06/13)



CERTIFICATE OF COMPLIANCE	NRCC-LTI-02-E
Indoor Lighting - Lighting Controls	(Page 2 of 5)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>

<input checked="" type="checkbox"/>	Before an occupancy permit is granted for a newly constructed building or area, or a new lighting system serving a building, area, or site is operated for normal use, indoor lighting controls serving the building, area, or site shall be certified as meeting the Acceptance Requirements for Code Compliance in accordance with Section 130.4.(a). The controls required to meet the Acceptance Requirements include automatic daylight controls, automatic shut-OFF controls, and demand responsive controls.
-------------------------------------	---

A separate document must be filled out for Conditioned and Unconditioned Spaces. This page is used only for the following:

**CONDITIONED SPACES**       **UNCONDITIONED SPACES**

<b>MANDATORY AND PRESCRIPTIVE INDOOR LIGHTING CONTROL SCHEDULE, PAF CALCULATION, and FIELD INSPECTION CHECKLIST</b>															
Lighting Control Schedule			Standards Complying With <sup>1</sup> (✓ all that apply, or enter 'E' if Exempted)							PAF Credit Calculation <sup>2</sup>			✓ if Acceptance Test Required	Field Inspector	
			Watts of Controlled Lighting	PAF	Control Credit (K x L)	K	L	M	N	O					
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
Location in Building	Type/ Description of Lighting Control (i.e.: occupancy sensor, automatic time switch, dimmer, automatic daylight, etc...)	# of Units	\$130.1(a)	\$130.0(b)	\$130.1(c)	\$130.1(d)	\$130.1(e)	\$140.6(a)2	\$140.6(d)					Pass	Fail
<b>Lobby area</b>	<b>Continuous dimming</b>	<b>3</b>	✓	✓						N/A	N/A	N/A	✓	<input type="checkbox"/>	<input type="checkbox"/>
<b>Corridor 1</b>	<b>Occupancy Sensor</b>	<b>2</b>	✓		✓					N/A	N/A	N/A	✓	<input type="checkbox"/>	<input type="checkbox"/>
														<input type="checkbox"/>	<input type="checkbox"/>
														<input type="checkbox"/>	<input type="checkbox"/>
														<input type="checkbox"/>	<input type="checkbox"/>
														<input type="checkbox"/>	<input type="checkbox"/>



# §130.1, §130.4 and the Field Inspector

- **At Final verify:**
  - Multi-level lighting controls installed in accordance with [TABLE 130.1-A](#)
  - Shut-OFF controls installed to comply with completely OFF, or Partial ON/OFF requirements
- **Verify req. [NRCA-LTI](#) forms**
- **Verify req. [NRCA-LTI](#) forms**
  - Must be signed by [CLCATT](#) when req.



*\* Refer to [NRCA-LTI-02](#)*

**AUTOMATIC DAYLIGHTING CONTROL ACCEPTANCE DOCUMENT**

CERTIFICATE OF ACCEPTANCE		NRCA-LTI-02-A
Lighting Control Acceptance Document		(Page 1 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

<i>Note: For more than 3 spaces attach additional sets of pages 2 through 5, as required.</i>	Enforcement Agency Use: Checked by/Date
---	---

<b>Automatic Shut-off Controls: Automatic Time Switch Control and Occupant Sensor</b>	
<b>Intent:</b>	Lights are turned off or set to a lower level when not needed per Section 110.9(a) & 130.1(c).
<b>Guidance</b>	
This acceptance test form must be filled out for all newly-installed lighting control systems of the following types:	
<ul style="list-style-type: none"> <li>I. Automatic Time Switch Controls</li> <li>II. Occupancy Sensors</li> <li>III. Partial-OFF occupancy sensors</li> <li>IV. Partial-ON occupancy sensors (<u>only if used to claim a Power Adjustment Factor</u>)</li> <li>V. Occupancy Sensors serving small zones in large open plan offices (<u>only if used to claim a Power Adjustment Factor</u>)</li> </ul>	
For automatic daylighting controls use acceptance test form NRCA-LTI-03-A; for demand responsive lighting controls, use acceptance test form NRCA-LTI-04-A.	
The tests on this certificate are required by Section 140.6(a)2 and 130.4(a) of the Building Energy Efficiency Standards 2013. The tests themselves are described in Sections 140.6(a)2 and in Reference Appendix NA7.6.	

<b>A. Construction Inspection</b>	
Fill out Section A to cover spaces 1 through 3 that are functionally tested under Section B. Make as many copies of pages 2-5 as are required to test all spaces in the building, and attach to page 1.	
Instruments needed to perform tests include, but are not limited to: hand-held amperage meter, power meter, or light meter	
<b>1</b>	<b>Automatic Time Switch Controls Construction Inspection—confirm for all listed in Section B</b>
a.	All automatic time switch controls are programmed for (check all):
<input type="checkbox"/>	Weekdays
<input type="checkbox"/>	Weekend
<input type="checkbox"/>	Holidays
b.	Document for the owner automatic time switch programming (check all):
<input type="checkbox"/>	Weekdays settings
<input type="checkbox"/>	Weekend settings
<input type="checkbox"/>	Holidays settings
<input type="checkbox"/>	Set-up settings
<input type="checkbox"/>	Preference program setting
<input type="checkbox"/>	Verify the correct time and date is properly set in the time switch
<input type="checkbox"/>	Verify the battery is installed and energized
<input type="checkbox"/>	Override time limit is no more than 2 hours
<input type="checkbox"/>	Occupant Sensors and Automatic Time Switch Controls have been certified to the Energy Commission in accordance with the applicable provision in Section 110.9 of the Standards, and model numbers for all such controls are listed on the Commission database as Certified Appliance and Control Devices
<b>2</b>	<b>Occupancy Sensor Construction Inspection—confirm for all listed in Section B</b>

# AUTOMATIC DAYLIGHTING CONTROL ACCEPTANCE DOCUMENT



<b>CERTIFICATE OF ACCEPTANCE</b>		<b>NRCA-LTI-02-A</b>
Lighting Control Acceptance Document		(Page 2 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

	?	Occupancy sensors are not located within four feet of any HVAC diffuser
	?	Ultrasonic occupancy sensors do not emit audible sound 5 feet from source

## B. Functional Testing of Lighting Controls

**Representative Spaces Selected**  
 For every space in the building, conduct functional tests I through V below if applicable. If there are several geometrically similar spaces that use the same lighting controls, test only one space and list in the cells below which "untested spaces" are represented by that tested space.  
 EXCEPTION: For buildings with up to seven (7) occupancy sensors, all occupancy sensors shall be tested. (NA7.6.2.3)

?	1	Tested space/ room name: _____ Space Type (office, corridor, etc) _____ Untested areas/rooms _____
?	2	Tested space/ room name: _____ Space Type (office, corridor, etc) _____ Untested areas/rooms _____
?	3	Tested space/ room name: _____ Space Type (office, corridor, etc) _____ Untested areas/rooms _____

Functional Tests		Tested Space Number		
Confirm compliance (Y/N) for all control system types (I-V) present in each space:				
1. Automatic Time Switch Controls		1	2	3
<b>Step 1: Simulate occupied condition</b>				
a.	All lights can be turned on and off by their respective area control switch	Y / N	Y / N	Y / N
b.	Verify the switch only operates lighting in the ceiling-height partitioned area in which the switch is located	Y / N	Y / N	Y / N
<b>Step 2: Simulate unoccupied condition</b>				
a.	All lighting, including emergency and egress lighting, turns off. Exempt lighting may remain on per Section 130.1(c)1 and 130,1(a)1.	Y / N	Y / N	Y / N
b.	Manual override switch allows only the lights in the selected ceiling height partitioned space where the override switch is located and remain on no longer than 2 hours (unless serving public areas and override switch is captive key type).	Y / N	Y / N	Y / N
<b>Step 3: System returned to initial operating conditions</b>		Y / N	Y / N	Y / N

2. Occupancy Sensors		1	2	3
<b>Step 1: Simulate an unoccupied condition</b>				
a.	Lights controlled by occupancy sensors turn off within a maximum of 30 minutes from start of an unoccupied condition per Standard Section 110.9(a)	Y / N	Y / N	Y / N
b.	The occupant sensor does not trigger a false "on" from movement in an area adjacent to the controlled space or from HVAC operation	Y / N	Y / N	Y / N
<b>Step 2: Simulate an occupied condition</b>				
a.	Status indicator or annunciator operates correctly	Y / N	Y / N	Y / N

# AUTOMATIC DAYLIGHTING CONTROL ACCEPTANCE DOCUMENT



<b>CERTIFICATE OF ACCEPTANCE</b>		<b>NRCA-LTI-02-A</b>
Lighting Control Acceptance Document		(Page 3 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

b.	Lights controlled by occupancy sensors turn on immediately upon an occupied condition <i>OR</i> sensor indicates space is "occupied" and lights may be turned on manually	Y / N	Y / N	Y / N
<b>Step 3:</b> System returned to initial operating conditions		Y / N	Y / N	Y / N

**AUTOMATIC DAYLIGHTING CONTROL ACCEPTANCE DOCUMENT**

CERTIFICATE OF ACCEPTANCE		NRCA-LTI-02-A
Lighting Control Acceptance Document		(Page 4 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

3. Partial Off Occupancy Sensor		1	2	3
<b>Step 1: Simulate an unoccupied condition</b>				
a.	Lights go to partial off state within a maximum of 30 minutes from start of an unoccupied condition per Standard Section 110.9(a)	Y / N	Y / N	Y / N
b.	The occupant sensor does not trigger a false "on" from movement in an area adjacent to the controlled space or from HVAC operation. For library book stacks or warehouse aisle, activity beyond the stack or aisle shall not activate the lighting in the aisle or stack.	Y / N	Y / N	Y / N
c.	In the partial off state, lighting shall consume no more than 50% of installed lighting power, or: <ul style="list-style-type: none"> <li>No more than 60% of installed lighting power for metal halide or high pressure sodium lighting in warehouses.</li> <li>No more than 60% of installed lighting power for corridors and stairwells in which the installed lighting power is 80 percent or less of the value allowed under the Area Category Method.</li> </ul> Light level may be used as a proxy for lighting power when measurements are taken	Y/N	Y / N	Y / N
<b>Step 2: Simulate an occupied condition</b>				
a.	The occupant sensing controls shall turn lights fully ON in each separately controlled areas, Immediately upon an occupied condition	Y / N	Y / N	Y / N

4. Partial On Occupancy Sensors		1	2	3
<b>Step 1. -Simulate an occupied condition. Verify partial on operation.</b>				
a.	Immediately upon an occupied condition, the first stage activates between 30 to 70% of the lighting automatically.	Y / N	Y / N	Y / N
b.	After the first stage occurs, manual switches allow an occupant to activate the alternate set of lights, activate 100% of the lighting power, and manually deactivate all of the lights.	Y / N	Y / N	Y / N
<b>Step 2. Simulate an unoccupied condition</b>				
a.	Both stages (automatic on and manual on) lights turn off within a maximum of 30 minutes from start of an unoccupied condition per Standard Section 110.9(a)	Y / N	Y / N	Y / N
b.	The occupant sensor does not trigger a false "on" from movement in an area adjacent to the controlled space or from HVAC operation	Y / N	Y / N	Y / N

5. Additional test for Occupancy Sensors Serving Small Zones in Office Spaces Larger than 250 Square Feet, to Qualify for a Power Adjustment Factor (PAF)		1	2	3
<i>First, complete Functional Test 2 (above ) for each controlled zone</i>				
<b>Step 1. Verify area served and compare actual PAF with claimed PAF. Refer to Functional Test II.</b>				
a.	Area served by controlled lighting (square feet)			
b.	Enter PAF corresponding to controlled area from line (a) above (<125sf for PAF=0.4, 126-250sf for PAF=0.3, 251-500sf for PAF=0.2).			
c.	Enter PAF claimed for occupant sensor control in this space from the Certificate of Compliance			
d.	The PAF corresponding to the controlled area (line b), is less than or equal to the PAF claimed in the compliance documentation (line c)	Y / N	Y / N	Y / N
e.	Sensors shall not trigger in response to movement in adjacent walkways or workspaces.	Y / N	Y / N	Y / N

**AUTOMATIC DAYLIGHTING CONTROL ACCEPTANCE DOCUMENT**



<b>CERTIFICATE OF ACCEPTANCE</b>		<b>NRCA-LTI-02-A</b>
Lighting Control Acceptance Document		(Page 5 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

f.	All steps are conducted in Functional Test 2 "Occupancy Sensor (On Off Control)" and all answers are Yes (Y)	Y / N	Y / N	Y / N
----	--	-------	-------	-------

C	Testing Results	PASS / FAIL	PASS / FAIL	PASS / FAIL
	<b>I Automatic Time Switch Controls</b> (all answers must be Y).	<b>Pass</b>		
	<b>II Occupancy Sensor (On Off Control)</b> (all answers must be Y).	<b>Pass</b>		
	<b>III Partial Off Occupancy Sensor</b> (all answers must be Y). For warehouses, library book stacks, corridors, stairwells in nonresidential buildings must also be accompanied by passing Test I or Test II.	<b>Pass</b>		
	<b>IV Partial On Occupant Sensor for PAF</b> (all answers must be Y).	<b>Pass</b>		
	<b>V Occupant Sensor serving small zones for PAF</b> (all answers must be Y). Also must pass Test II	<b>N/A</b>		

D.	Evaluation :	
<input checked="" type="checkbox"/>	PASS: All applicable <b>Construction Inspection</b> responses are complete and all applicable <b>Equipment Testing Requirements</b> responses are positive (Y - yes)	

**AUTOMATIC DAYLIGHTING CONTROL ACCEPTANCE DOCUMENT**

<b>CERTIFICATE OF ACCEPTANCE</b>		<b>NRCA-LTI-02-A</b>
Lighting Control Acceptance Document		(Page 6 of 6)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

<b>Documentation author's Declaration Statement</b>	
1. I certify that this Certificate of Acceptance documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Documentation Author Company Name:	Date Signed:
Address:	CEA/HERS/ATT Certification Identification (If applicable):
City/State/Zip:	Phone:

<b>FIELD TECHNICIAN'S DECLARATION STATEMENT</b>	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> <li>The information provided on this Certificate of Acceptance is true and correct.</li> <li>I am the person who performed the acceptance verification reported on this Certificate of Acceptance (Field Technician).</li> <li>The construction or installation identified on this Certificate of Acceptance complies with the applicable acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA7.</li> <li>I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and signed by the responsible builder/installer and has been posted or made available with the building permit(s) issued for the building.</li> </ol>	
Field Technician Name:	Field Technician Signature:
Field Technician Company Name:	Position with Company (Title):
Address:	ATT Certification Identification (if applicable): <b>CALCTP Cert. #: 010113-15</b>
City/State/Zip:	Phone: <span style="float: right;">Date Signed:</span>

<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> <li>I am the Field Technician, or the Field Technician is acting on my behalf as my employee or my agent and I have reviewed the information provided on this Certificate of Acceptance.</li> <li>I am eligible under Division 3 of the Business and Professions Code in the applicable classification to accept responsibility for the system design, construction or installation of features, materials, components, or manufactured devices for the scope of work identified on this Certificate of Acceptance and attest to the declarations in this statement (responsible acceptance person).</li> <li>The information provided on this Certificate of Acceptance substantiates that the construction or installation identified on this Certificate of Acceptance complies with the acceptance requirements indicated in the plans and specifications approved by the enforcement agency, and conforms to the applicable acceptance requirements and procedures specified in Reference Nonresidential Appendix NA7.</li> <li>I have confirmed that the Certificate(s) of Installation for the construction or installation identified on this Certificate of Acceptance has been completed and is posted or made available with the building permit(s) issued for the building.</li> <li>I will ensure that a completed, signed copy of this Certificate of Acceptance shall be posted, or made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a signed copy of this Certificate of Acceptance is required to be included with the documentation the builder provides to the building owner at occupancy.</li> </ol>	
Responsible Acceptance Person Name:	Responsible Acceptance Person Signature:
Responsible Acceptance Person Company Name:	Position with Company (Title):
Address:	CSLB License:
City/State/Zip:	Phone: <span style="float: right;">Date Signed:</span>



# Electrical Power Distribution

- **New mandatory requirements in §130.5**
- **Requirements for:**
  - Service metering
    - TABLE 130.5-A
  - Disaggregation of electrical circuits
    - TABLE 130.5-B
  - Voltage Drop
  - 120-Volt Receptacles
  - Demand Responsive controls
  - EMCS

- (c) When certification is required by Title 24, Part 1, Section 10-103-A, the acceptance testing specified by Section 130.4 shall be performed by a Certified Lighting Controls Acceptance Test Technician (CLCATT). If the CLCATT is operating as an employee, the CLCATT shall be employed by a Certified Lighting Controls Acceptance Test Employer. The CLCATT shall disclose on the Certificate of Acceptance a valid CLCATT certification identification number issued by an approved Acceptance Test Technician Certification Provider. The CLCATT shall complete all Certificate of Acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

**NOTE:** Authority cited: Sections 25402, 25402.1, 25213, Public Resources Code. Reference: Sections 25007, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8 and 25910, Public Resources Code.

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## SECTION 130.5 –ELECTRICAL POWER DISTRIBUTION SYSTEMS

- (a) **Service Metering.** Each electrical service shall have permanently installed user-accessible metering of total electrical energy use per TABLE 130.5-A.
- (b) **Disaggregation of Electrical Circuits.** Electrical power distribution systems shall be designed to permit the disaggregated measurement of electrical load energy uses downstream from the service meter according to TABLE 130.5-B. Additive and subtractive methods may be used to determine aggregate and disaggregated energy use. This may be accomplished by any of the following methods:
1. Separate switchboards, motor control centers, or panelboards to which are connected only the required load or group of loads; or
  2. Subpanels of the above to which are connected only the required load or group of loads and for which the subpanel load can be independently measured in aggregate; or
  3. Branch circuits, taps or disconnects requiring overcurrent protection devices rated 60 amperes or greater.

**EXCEPTION to Section 130.5(a)** Buildings for which the utility company provides a meter for occupant or user use that indicates instantaneous kW demand and kWh for a user-resettable period.

**EXCEPTION to Section 130.5(a)** Buildings for which the utility company provides a meter for occupant or user use that indicates instantaneous kW demand and kWh for a user-resettable period.

**EXCEPTION 1 to Section 130.5(b)** Buildings for which a complete metering and measurement system is provided that at a minimum measures and reports the loads called for in TABLE 130.5-B.

**EXCEPTION 2 to Section 130.5(b)** Alterations where all of the following conditions exist are not required to comply with this section:

- A. The following existing equipment remains in place:
- i. Service distribution switchboards or panelboards; and
  - ii. Feeders; and
  - iii. Motor control centers or panelboards.
- B. Existing equipment included in Item A (above) remains unaltered except for:
- i. Changes to load circuit connections; or
  - ii. Changes to the quantity of outgoing overcurrent protection devices; or
  - iii. Changes to the ampacity of outgoing overcurrent protection devices.

(c) **Voltage Drop**

1. **Feeders.** Feeder conductors shall be sized for a maximum voltage drop of 2 percent at design load.
2. **Branch Circuits.** Branch circuit conductors shall be sized for a maximum voltage drop of 3 percent at design load.

**EXCEPTION to Section 130.5(c):** Feeder conductors and branch circuits that are dedicated to emergency services.

**(d) Circuit Controls for 120-Volt Receptacles.** In all buildings, both controlled and uncontrolled 120 volt receptacles shall be provided in each private office, open office area, reception lobby, conference room, kitchenette in office spaces, and copy room. Additionally, hotel/motel guest rooms shall comply with Item 5. Controlled receptacles shall meet the following requirements, as applicable:

1. Electric circuits serving controlled receptacles shall be equipped with automatic shut-OFF controls following the requirements prescribed in Section 130.1(c)(1 through 5); and
2. At least one controlled receptacle shall be installed within 6 feet from each uncontrolled receptacle or a split-wired duplex receptacle with one controlled and one uncontrolled receptacle shall be installed; and
3. Controlled receptacles shall have a permanent marking to differentiate them from uncontrolled receptacles; and
4. For open office areas, controlled circuits shall be provided and marked to support installation and configuration of office furniture with receptacles that comply with Section 130.5(d) 1, 2, and 3; and
5. For hotel and motel guest rooms at least one-half of the 120-volt receptacles in each guest room shall be controlled receptacles that comply with Section 130.5(d)1, 2, and 3. Electric circuits serving controlled receptacles shall have captive card key controls, occupancy sensing controls, or automatic controls such that, no longer than 30 minutes after the guest room has been vacated, power is switched off.
6. Plug-in strips and other plug-in devices that incorporate an occupant sensor shall not be used to comply with this requirement.

**EXCEPTION 1 to Section 130.5(d):** In open office areas, controlled circuit receptacles are not required if, at time of final permit, workstations are installed, and each workstation is equipped with an occupant sensing control that is permanently mounted in each workstation, and which controls a hardwired, nonresidential-rated power strip. Plug-in strips and other plug-in devices that incorporate an occupant sensor shall not be used for this exception.

**EXCEPTION 2 to Section 130.5(d):** Receptacles that are only for the following purposes:

- i. Receptacles specifically for refrigerators and water dispensers in kitchenettes.
- ii. Receptacles located a minimum of six feet above the floor that are specifically for clocks.
- iii. Receptacles for network copiers, fax machines, A/V and data equipment other than personal computers in copy rooms.
- iv. Receptacles on circuits rated more than 20 amperes.

**(e) Demand responsive controls and equipment.** Demand responsive controls and equipment shall be capable of receiving and automatically responding to at least one standards based messaging protocol which enables demand response after receiving a demand response signal.

**(f) Energy Management Control System (EMCS).**

1. An EMCS may be installed to comply with the requirements of one or more lighting controls if it meets the following minimum requirements:
  - A. Provides all applicable functionality for each specific lighting control or system for which it is installed in accordance with Section 110.9; and
  - B. Complies with all applicable Lighting Control Installation Requirements in accordance with Section 130.4 for each specific lighting control or system for which it is installed; and
  - C. Complies with all applicable application requirements for each specific lighting control or system for which it is installed, in accordance with Part 6.
2. An EMCS may be installed to comply with the requirements of a thermostat if it complies with all applicable application requirements for each thermostat in accordance with Part 6.

**TABLE 130.5-A MINIMUM REQUIREMENTS FOR METERING OF ELECTRICAL LOAD**

<b>Meter Type</b>	<b>Services rated 50 kVA or less</b>	<b>Services rated more than 50kVA and less than or equal to 250 kVA</b>	<b>Services rated more than 250 kVA and less than or equal to 1000kVA</b>	<b>Services rated more than 1000kVA</b>
Instantaneous (at the time) kW demand	Required	Required	Required	Required
Historical peak demand (kW)	Not required	Not required	Required	Required
Resettable kWh	Required	Required	Required	Required
kWh per rate period	Not required	Not required	Not required	Required

**TABLE 130.5-B MINIMUM REQUIREMENTS FOR SEPARATION OF ELECTRICAL LOAD**

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



# §130.5 and the Plans Examiner

STATE OF CALIFORNIA Electrical Power Distribution CERES/PRD/ELC-01-E (Revised 08/13) CALIFORNIA ENERGY COMMISSION		NRCC-ELC-01-E (Page 1 of 8)
CERTIFICATE OF COMPLIANCE Electrical Power Distribution		NRCC-ELC-01-E (Page 1 of 8)
Project Name: 2013 CALBO Training Sample		Date Prepared: 01/01/14
Project Address: 2013 CALBO Drive	Climate Zone: 12	Conditioned Floor Area : 5,000 ft <sup>2</sup> Unconditioned Floor Area :
General Information		
Building Type:	<input checked="" type="checkbox"/> Nonresidential	<input type="checkbox"/> High-Rise Residential <input type="checkbox"/> Hotel/Motel
<input type="checkbox"/> Schools	<input type="checkbox"/> Relocatable Public Schools	<input checked="" type="checkbox"/> Conditioned Spaces <input type="checkbox"/> Unconditioned Spaces
Phase of Construction:	<input checked="" type="checkbox"/> New Construction	<input type="checkbox"/> Addition <input type="checkbox"/> Alteration
1. I certify that this Certificate of Compliance documentation is accurate and complete.		
Documentation Author Name:	Documentation Author Signature:	
Company:	Signature Date:	
Address:	CEA/HERS Certification Identification (if applicable):	
City/State/Zip:	Phone:	
RESPONSIBLE PERSON'S DECLARATION STATEMENT		
I certify the following under penalty of perjury, under the laws of the State of California:		
1. The information provided on this Certificate of Compliance is true and correct.		
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).		
3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.		
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.		
5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.		
Responsible Designer Name:	Responsible Designer Signature:	
Company:	Date Signed:	
Address:	License:	
City/State/Zip:	Phone:	

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance June 2013

- **Verify specifications on NRCC-ELC-01 form**
  - Service metering
  - Disaggregation of circuits
  - Voltage drop
  - 120 volt receptacles
- **Form must be on plans**
- **Must be registered starting 1/1/15**



# Electrical Power Distribution

CEC-NRCC-ELC-01-E (Revised 06/13)  
CALIFORNIA ENERGY COMMISSION

<b>CERTIFICATE OF COMPLIANCE</b>		<b>NRCC-ELC-01-E</b>
<b>Electrical Power Distribution</b>		<b>(Page 1 of 8)</b>
Project Name: 2013 CALBO Training Sample	Date Prepared: 01/01/14	

<b>Project Address:</b> 2013 CALBO Drive	<b>Climate Zone:</b> 12	<b>Conditioned Floor Area :</b> 5,000 ft <sup>2</sup> <b>Unconditioned Floor Area :</b>
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<b>General Information</b>			
<b>Building Type:</b>	<input checked="" type="checkbox"/> Nonresidential	<input type="checkbox"/> High-Rise Residential	<input type="checkbox"/> Hotel/Motel
<input type="checkbox"/> Schools	<input type="checkbox"/> Relocatable Public Schools	<input checked="" type="checkbox"/> Conditioned Spaces	<input type="checkbox"/> Unconditioned Spaces
<b>Phase of Construction:</b>	<input checked="" type="checkbox"/> New Construction	<input type="checkbox"/> Addition	<input type="checkbox"/> Alteration

<b>1. I certify that this Certificate of Compliance documentation is accurate and complete.</b>	
Documentation Author Name:	Documentation Author Signature:
Company:	Signature Date:
Address:	CEA/ HERS Certification Identification (if applicable):
City/State/Zip:	Phone:

<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>	
<p>I certify the following under penalty of perjury, under the laws of the State of California:</p> <ol style="list-style-type: none"> <li>1. The information provided on this Certificate of Compliance is true and correct.</li> <li>2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).</li> <li>3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.</li> <li>4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.</li> <li>5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.</li> </ol>	
Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip:	Phone:



# Electrical Power Distribution

CEC-NRCC-ELC-01-E (Revised 06/13)  
CALIFORNIA ENERGY COMMISSION

<b>CERTIFICATE OF COMPLIANCE</b>	<b>NRCC-ELC-01-E</b>
<b>Electrical Power Distribution</b>	<b>(Page 2 of 8)</b>
Project Name: 2013 CALBO Training Sample	Date Prepared: 01/01/14

## A. Electrical Service Metering

Each newly installed electrical service (in both existing and newly constructed buildings) is required to be metered, as set out in Table 130.5-A, which is reproduced below.  
 Fill out a separate line for each electrical service that is connected to the building.

Electrical Service Schedule	Electrical Service Rating	Metering Capabilities (check all that are present)				Field Inspector	
		C	D	E	F	Pass	Fail
A	B	C	D	E	F	G	
		Instantaneous (at the time) kW demand	Historical peak demand (kW)	Resettable kWh	kWh per rate period	Pass	Fail
Designation/location in building/description	kVA						
Office Space	500	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Warehouse Area	250	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Table 130.5-A - MINIMUM REQUIREMENTS FOR METERING OF ELECTRICAL LOAD**

Meter Rating (kVA)	50 kVA or less	More than 50kVA and less than or equal to 250 kVA	More than 250 kVA and less than or equal to 1000kVA	Services rated more than 1000kVA
Instantaneous (at the time) kW demand	Required	Required	Required	Required
Historical peak demand (kW)	Not required	Not required	Required	Required
Resettable kWh	Required	Required	Required	Required
kWh per rate period	Not required	Not required	Not required	Required



# Electrical Power Distribution

<b>CERTIFICATE OF COMPLIANCE</b>		<b>NRCC-ELC-01-E</b>
<b>Electrical Power Distribution</b>		<b>(Page 3 of 8)</b>
Project Name: 2013 CALBO Training Sample	Date Prepared: 01/01/14	

## **B. Disaggregation of Electrical Circuits**

- Each newly installed switchboard, panel, and motor control center (in both existing and newly constructed buildings) is required to be disaggregated according to the requirements of Table 130.5-B, shown on the next page.
- Individual branch circuits, taps or disconnects that require overcurrent protection devices rated 60A or greater are exempt.
- As an alternative, current transformers can be added for individual branch circuits and loads throughout the building, and a permanent measurement system can be installed. In this case, disaggregated wiring would not be required as long as the metering system allows the equivalent disaggregated measurements.
- Fill out a separate line for each switchboard, motor control center, panelboard and subpanel.





**Electrical Power Distribution**

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**B. Disaggregation of Electrical Circuits (continued)**

**Table 130.5-B - MINIMUM REQUIREMENTS FOR SEPARATION OF ELECTRICAL LOAD**

Table 130.5 – B sets the upper limit on how many load(s) of each type can be supplied by each feeder. A feeder may not supply loads of more than one type unless the service is rated at 50 kVA or less. For instance, on the fifth row of the table, one feeder on a service >50 kVA could be used to supply all the plug loads on a floor of a building, provided that there are no areas in which more than 25kVA of plug load is supplied to a space less than 5000sf

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



# Electrical Power Distribution

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## C. Voltage Drop

- Attach voltage drop worksheet to this form,
- Field inspector has discretion to approve the worksheets; the tables shown below in this section are advisory only
- Feeder conductors and branch circuits that are dedicated to emergency services are exempt from these requirements.
- To calculate branch circuit length, the approximate centroid of the load may be used if the actual conductor length is not known.
- When calculating branch circuit loads, receptacle loads may be derated using a load factor of 75%
- An advisory table of typical power factors is shown below
- Advisory tables of typical maximum feeder and branch circuit lengths are shown on the following page. Tables assume 1.0 power factor and that the circuit current is 80% of the rated value.

	Field Inspector	
	Pass	Fail
Feeders. Feeder conductors shall be sized for a maximum voltage drop of 2 percent at design load.	<input type="checkbox"/>	<input type="checkbox"/>
Branch Circuits. Branch circuit conductors shall be sized for a maximum voltage drop of 3 percent at design load.	<input type="checkbox"/>	<input type="checkbox"/>

Compliance Manual, Chapter 8, Table 8 2: Typical Power Factors for Voltage Drop Calculations

Load Type	Default Power Factor at 120 volts	Default Power Factor at 277 volts	Clarifying Notes
Fluorescent lighting	0.95	0.95	
Compact fluorescent lighting	0.9 (hardwired) 0.5 (GU-24)	0.9 (hardwired) 0.3 (GU-24)	NPF magnetic ballasts use GU-24 values
LED lighting	0.7	0.5	May be higher if specifications call for high power factor drivers
Incandescent lighting	1.0	1.0	
HID lighting	0.9	0.9	May be lower if NPF ballasts are specified
HVAC packages	0.85	0.9	
Other motors <5 HP	0.8	0.8	
Other motors >5 HP	0.85	0.85	
Kitchen equipment	0.9	N/A	
Receptacles	0.6	N/A	For dedicated receptacles, may be rated according to the load
Electric heating including hot water	1.0	1.0	
Other	0.85	0.85	



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## C. Voltage Drop (continued)

Compliance Manual, Chapter 8, Table 8 5 Voltage Drop for Common Copper Wire Gauges and Current Loads

Wire gauge	Circuit Current (Amps)	Maximum Feeder Length (feet)					Maximum Branch Circuit Length (feet)				
		120	208	240	277	480	120	208	240	277	480
14	12	39	67	78	90	156	58	101	117	135	233
12	16	46	80	93	107	185	69	120	139	160	278
10	24	48	83	96	111	192	72	125	144	166	288
8	32	57	99	115	132	229	86	149	172	199	344
6	40	73	127	146	169	293	110	190	220	253	439
4	52	89	154	178	206	356	134	232	267	309	535
2	72	103	178	206	237	412	154	267	309	356	617
0	96	123	212	245	283	490	184	319	368	424	735
00	108	137	238	274	317	549	206	357	412	475	823
0000	144	163	283	327	377	654	245	425	490	566	980
250 (kcmil)	164	170	294	340	392	679	255	441	509	588	1019
300	184	181	314	362	418	725	272	471	543	627	1087
350	200	195	338	390	450	779	292	506	584	675	1169
500	248	224	388	448	517	896	336	582	672	776	1344

Compliance Manual, Chapter 8, Table Error! No text of specified style in document.-1 Voltage Drop for Common Aluminum Wire Gauges and Current Loads

Wire gauge	Circuit Current (Amps)	Maximum Feeder Length (feet)					Maximum Branch Circuit Length (feet)				
		120	208	240	277	480	120	208	240	277	480
14*	12	24	41	47	55	95	36	62	71	82	142
12*	16	28	49	56	65	113	42	73	85	98	169
10	24	29	51	59	68	118	44	76	88	102	176
8	32	35	61	70	81	140	53	91	105	121	210
6	40	45	77	89	103	178	67	116	134	154	267
4	52	54	94	109	126	218	82	142	163	188	327
2	72	62	108	125	144	250	94	162	187	216	375
0	96	74	129	149	172	298	112	193	223	258	446
00	108	84	145	167	193	334	125	217	251	289	501
0000	144	99	172	198	229	397	149	258	298	344	595
250	164	103	179	207	239	413	155	269	310	358	620
300	184	111	192	221	255	442	166	287	332	383	663
350	200	119	206	238	274	475	178	309	356	411	713
500	248	137	237	273	316	547	205	355	410	473	820



# Electrical Power Distribution

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## D. Circuit Controls for 120-Volt Receptacles

- Controlled 120 volt receptacles shall be provided, as required by Section 130.5(d) of the Standards.**
- In open office areas, controlled circuit receptacles are not required if, at time of final permit, workstations are installed, and each workstation is equipped with an occupant sensing control that is permanently mounted in each workstation, and which controls a hardwired, nonresidential-rated power strip. Plug-in strips and other plug-in devices that incorporate an occupant sensor shall not be used for this exception.**
- Receptacles that are only for the following purposes are exempt:**
  - Receptacles specifically for refrigerators and water dispensers in kitchenettes.
  - Receptacles located a minimum of six feet above the floor that are specifically for clocks.
  - Receptacles for network copiers, fax machines, A/V and data equipment other than personal computers in copy rooms.

	Field Inspector	
	Pass	Fail
1. At least one controlled receptacle is installed within 6 feet of each uncontrolled receptacle, or split-wired duplex receptacles are installed, that have one controlled and one uncontrolled receptacle. This applies in all of the following spaces: <ul style="list-style-type: none"> <li>• Private offices, open office areas</li> <li>• Receptions and lobbies</li> <li>• Conference rooms</li> <li>• Kitchenettes in office spaces</li> <li>• Copy room</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
2. Electric circuits serving controlled receptacles are equipped with automatic shut-OFF controls following the requirements prescribed in Section 130.1(c)1 through 5 (in many cases this will mean that the receptacles are connected to the same automatic shut-OFF system as the general lighting of the space).	<input type="checkbox"/>	<input type="checkbox"/>
3. Controlled receptacles shall have a permanent marking to differentiate them from uncontrolled receptacles.	<input type="checkbox"/>	<input type="checkbox"/>
4. For open office areas, controlled circuits shall be provided and marked to support installation and configuration of office furniture with receptacles that comply with Section 130.1(a)130.5(d) 1, 2, and 3.	<input type="checkbox"/>	<input type="checkbox"/>
5. For hotel and motel guest rooms at least one-half of the 120-volt receptacles in each guest room are controlled receptacles that comply with Section 130.5(d)1, 2, and 3 (see numbers 1,2 and 3 above). Electric circuits serving controlled receptacles have captive card key controls, occupancy sensing controls, or automatic controls such that, no longer than 30 minutes after the guest room has been vacated, power is switched off.	<input type="checkbox"/>	<input type="checkbox"/>
6. Plug-in strips and other plug-in devices that incorporate an occupant sensor are not used to comply with any of these requirements.	<input type="checkbox"/>	<input type="checkbox"/>



## §130.5 and the Field Inspector

- **Verify at Final**
  - Elect. services are metered
  - Switchboards, panels, etc. are disaggregated
  - Feeder and branch circuit size
  - 120 volt receptacles when req.
- Use [NRCC-ELC-01](#) as inspector checklist





*Let's talk about the changes  
to the Energy Standards –  
Prescriptive Measures  
(New construction)*



# Cool Roofs, Fenestration, etc.

## 2008 – §143(a)

- Cool roof reqs. dependent on:
  - Slope
  - Climate zone
  - Density (lb/ft<sup>2</sup>)
- Windows/skylights must meet U-factor and SHGC reqs.
- Req. in TABLE 143-A through 143-C

## 2013 – §140.3(a)

- Cool roofs:
  - Density criteria removed
  - Solar reflectance trade-off in TABLE 140.3
- Windows/skylights
  - Must meet min. VT reqs.
- New air barrier reqs.
  - Approved materials in TABLE 140.3-A
- Req. in TABLE 140.3-B through 140.3-D

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## SECTION 140.3 – PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES

A building complies with this section by being designed with and having constructed and installed either: (1) envelope components that comply with each of the requirements in Subsection (a) for each individual component and the requirements of Subsection (c) where they apply; or (2) an envelope that complies with the overall requirements in Subsection (b) and the requirements of Subsection (c) where they apply.

(a) **Envelope Component Approach.**

1. **Exterior roofs and ceilings.** Exterior roofs and ceilings shall comply with each of the applicable requirements in this subsection:

- A. **Roofing Products.** Shall meet the requirements of Section 110.8 and the applicable requirements of Subsections i through ii:

- i. Nonresidential buildings:

- a. Low-sloped roofs in Climate Zones 1 through 16 shall have:

1. A minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75; or
2. A minimum Solar Reflectance Index (SRI) of 75.

**EXCEPTION 1 to Section 140.3(a)1Aia:** Wood-framed roofs in Climate Zones 3 and 5 are exempt from the requirements of Section 140.3(a)1Aia if the roof assembly has a U-factor of 0.039 or lower.

**EXCEPTION 2 to Section 140.3(a)1Aia:** Metal building roofs in Climate Zones 3 and 5 are exempt from the requirements if the roof assembly has a U-factor of 0.048 or lower.

**EXCEPTION 3 to Section 140.3(a)1Aia:** Roof constructions that have thermal mass with a weight of at least 25 lb/ft<sup>2</sup> over the roof membrane are exempt from the requirements of Section 140.3(a)1Aia.

**EXCEPTION 4 to SECTION 140.3(a)1Aia:** An aged solar reflectance less than 0.63 is allowed provided the maximum roof/ceiling U-factor in TABLE 140.3 is not exceeded.

- b. Steep-sloped roofs in Climate Zones 1 through 16 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.

- ii. High-rise residential buildings and hotels and motels:

- a. Low-sloped roofs in Climate Zones 10, 11, 13, 14 and 15 shall have a minimum aged solar reflectance of 0.55 and a minimum thermal emittance of 0.75, or a minimum SRI of 64.

**EXCEPTION to Section 140.3(a)1Aia:** Roof constructions that have thermal mass with a weight of at least 25 lb/ft<sup>2</sup> over the roof membrane .

- b. Steep-sloped roofs in Climate Zones 2 through 15 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.

TABLE 140.3 ROOF/CEILING INSULATION TRADEOFF FOR AGED SOLAR REFLECTANCE

Nonresidential					
Aged Solar Reflectance	Metal Building Climate Zone 1-16 U-factor	Wood framed and Other Climate Zone 1 & 5 U-factor	Wood Framed and Other Climate Zone 2-4, 9-16 U-factor	Wood Framed and Other, Climate Zone 6 U-factor	Wood Framed and Other Climate Zone 7 & 8 U-factor
0.62-0.60	0.061	0.045	0.036	0.065	0.059
0.59-0.55	0.054	0.041	0.034	0.058	0.053
0.54-0.50	0.049	0.038	0.032	0.052	0.048
0.49-0.45	0.047	0.035	0.030	0.047	0.044
0.44-0.40	0.043	0.033	0.028	0.043	0.040
0.39-0.35	0.039	0.031	0.027	0.039	0.037
0.34-0.30	0.035	0.029	0.025	0.037	0.035
0.29-0.25	0.033	0.027	0.024	0.034	0.032

8. **Relocatable Public School Buildings.** In complying with Sections 140.3(a)1 to 7 shall meet the following:
- A. Relocatable public school buildings shall comply with TABLE 140.3-B for a specific Climate Zone when the manufacturer or builder of the relocatable public school building certifies that the building is intended for use only in a specific Climate Zone; or
  - B. Relocatable public school buildings shall comply with TABLE 140.3-D for any Climate Zone when the manufacturer or builder of the relocatable public school building certifies that the building is intended for use in any Climate Zone; and
  - C. The manufacturer or builder of a relocatable public school building shall certify that components of the building comply with requirements of this section by:
    - i. The placement of two (2) metal identification labels on the building, one mechanically fastened and visible from the exterior and the other mechanically fastened to the interior frame above the ceiling at the end of the module., both labels stating (in addition to any other information by the Division of the State Architect or other law) "Complies with Title 24, Part 6 for all Climate Zones; and
    - ii. Identification of the location of the 2 labels on the plans submitted to the enforcing agency.
9. **Air Barrier.** To meet the requirement of Table 140.3-A, all buildings shall have a continuous air barrier that is designed and constructed to control air leakage into, and out of, the building's conditioned space. The air barrier shall be sealed at all joints for its entire length and shall be composed of:
- A. Materials that have an air permeance not exceeding  $0.004 \text{ cfm/ft}^2$ , under a pressure differential of 0.3 in. w.g. (1.57 psf) ( $0.02 \text{ L/m}^2$  at 75 pa), when tested in accordance with ASTM E2178; or  
**EXCEPTION to Section 140.3(a)9A:** Materials in TABLE 140.3-A shall be deemed to comply with Section 140.3(a)9A provided if all joints are sealed and all of the materials are installed as air barriers in accordance with the manufacturer's instructions.
  - B. Assemblies of materials and components that have an average air leakage not exceeding  $0.04 \text{ cfm/ft}^2$ , under a pressure differential of 0.3 in. w.g (1.57 psf) ( $0.2 \text{ L/m}^2$  at 75 pa), when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680, or ASTM E283; or  
**EXCEPTION to Section 140.3(a)9B:** The following materials shall be deemed to comply with Section 140.3(a)9B if all joints are sealed and all of the materials are installed as air barriers in accordance with the manufacturer's instructions:
    - i. Concrete masonry walls that have at least two coatings of paint or at least two coatings of sealer coating.
    - ii. Concrete masonry walls with integral rigid board insulation.
    - iii. Structurally Insulated Panels.
    - iv. Portland cement or Portland sand parge, or stucco, or a gypsum plaster, each with min. 1/2 inches thickness
  - C. The entire building has an air leakage rate not exceeding  $0.40 \text{ cfm/ft}^2$  at a pressure differential of 0.3 in w.g. (1.57 psf) ( $2.0 \text{ L/ m}^2$  at 75 pa), when the entire building is tested, after completion of construction, in accordance with ASTM E779 or another test method approved by the Commission.  
**EXCEPTION to Section 140.3(a)9:** Relocatable Public School Buildings.

TABLE 140.3-A MATERIALS DEEMED TO COMPLY - WITH SECTION 140.3(a)9A

	MATERIALS AND THICKNESS		MATERIALS AND THICKNESS
1	Plywood – min. 3/8 inches thickness	9	Built up roofing membrane
2	Oriented strand board – min. 3/8 inches thickness	10	Modified bituminous roof membrane
3	Extruded polystyrene insulation board – min. 1/2 inches thickness	11	Fully adhered single-ply roof membrane
4	Foil-back polyisocyanurate insulation board – min. 1/2 inches thickness	12	A Portland cement or Portland sand parge, or a gypsum plaster, each with min. 5/8-inches thickness
5	Closed cell spray foam with a minimum density of 2.0 pcf and a min. 2.0 inches thickness	13	Cast-in-place concrete, or-precast concrete
6	Open cell spray foam with a density no less than 0.4 pcf and no greater than 1.5 pcf, and a min. 5 1/2 inches thickness	14	Fully grouted concrete block masonry
7	Exterior or interior gypsum board min. 1/2 inches thickness	15	Sheet steel or sheet aluminum
8	Cement board – min. 1/2 inches-thickness		

**TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE; NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS)**

		Climate Zone																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
<b>Envelope</b>	<b>Maximum U-factor</b>	<b>Roofs/ Ceilings</b>	Metal Building	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	
			Wood Framed and Other	0.049	0.039	0.039	0.039	0.049	0.075	0.067	0.067	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
		<b>Walls</b>	Metal Building	0.113	0.061	0.113	0.061	0.061	0.113	0.113	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.061
			Metal-framed	0.098	0.062	0.082	0.062	0.062	0.098	0.098	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
			Mass Light <sup>1</sup>	0.196	0.170	0.278	0.227	0.440	0.440	0.440	0.440	0.440	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass Heavy <sup>1</sup>	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.160
		<b>Floors/ Soffits</b>	Mass	0.092	0.092	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.092	0.092	0.092	0.092	0.092	0.058
	Other		0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039	
	<b>Roofing Products</b>	<b>Low-sloped</b>	Aged Solar Reflectance	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	
			Thermal Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
		<b>Steep-Sloped</b>	Aged Solar Reflectance	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
			Thermal Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
	<b>Air Barrier</b>			NR	REQ	REQ	REQ	REQ	REQ	REQ									
	<b>Exterior Doors, Maximum U-factor</b>	Non-Swinging	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50	
Swinging		0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70		

Envelope	Fenestration	All Climate Zones				
			Fixed Window	Operable Window	Curtainwall or Storefront	Glazed Doors
Vertical	Area-Weighted Performance Rating	Max U-factor	0.36	0.46	0.41	0.45
		Max RSHGC	0.25	0.22	0.26	0.23
	Area-Weighted Performance Rating	Min VT	0.42	0.32	0.46	0.17
	Maximum WWR%	40%				
Skylights			Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted	
	Area-Weighted Performance Rating	Max U-factor	0.58	0.46	0.88	
		Max SHGC	0.25	0.25	NR	
	Area-Weighted Performance Rating	Min VT	0.49	0.49	0.64	
	Maximum SRR%	5%				

TABLE 140.3-C – PRESCRIPTIVE ENVELOPE CRITERIA FOR HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<b>Envelope</b>	<b>Maximum U-factor</b>	<b>Roofs/ Ceilings</b>	Metal Building	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	
			Wood Framed and Other	0.034	0.028	0.039	0.028	0.039	0.039	0.039	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
		<b>Walls</b>	Metal Building	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.057	0.057	0.057	0.057	0.057
			Metal-framed	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105
			Mass Light <sup>1</sup>	0.170	0.170	0.170	0.170	0.170	0.227	0.227	0.227	0.196	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass Heavy <sup>1</sup>	0.160	0.160	0.160	0.184	0.211	0.690	0.690	0.690	0.690	0.690	0.184	0.253	0.211	0.184	0.184	0.160
			Wood-framed and Other	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.042	0.059	0.059	0.042	0.042	0.042
<b>Roofing Products</b>	<b>Floors/ Soffits</b>	Mass	0.045	0.045	0.058	0.058	0.058	0.069	0.092	0.092	0.092	0.069	0.058	0.058	0.058	0.045	0.058	0.037	
		Other	0.034	0.034	0.039	0.039	0.039	0.039	0.039	0.071	0.039	0.039	0.039	0.039	0.039	0.039	0.034	0.039	0.034
	<b>Low-sloped</b>	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.55	0.55	0.55	NR	0.55	0.55	0.55	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	0.75	NR
	<b>Steep-sloped</b>	Aged Solar Reflectance	NR	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	NR
		Thermal Emittance	NR	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	NR
<b>Exterior Doors, Maximum U-factor</b>	Non-Swinging	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50	
	Swinging	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	

Envelope	Fenestration	All Climate Zones					
			Fixed Window	Operable Window	Curtainwall/ Storefront	Glazed Doors	
	Vertical	Area-Weighted Performance Rating	Max U-factor	0.36	0.46	0.41	0.45
			Max RSHGC	0.25	0.22	0.26	0.23
		Area-Weighted Performance Rating	Min VT	0.42	0.32	0.46	0.17
		Maximum WWR%	40%				
	Skylights			Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted	
		Area-Weighted Performance Rating	Max U-factor	0.58	0.46	0.88	
			Max SHGC	0.25	0.25	NR	
		Area-Weighted Performance Rating	Min VT	0.49	0.49	0.64	
Maximum SRR%	5%						

Notes:

1. Light mass walls are walls with a heat capacity of at least 7.0 Btu/h-ft<sup>2</sup> and less than 15.0 Btu/h-ft<sup>2</sup>. Heavy mass walls are walls with a heat capacity of at least 15.0 Btu/h-ft<sup>2</sup>.

**TABLE 140.3-D PRESCRIPTIVE ENVELOPE CRITERIA FOR RELOCATABLE PUBLIC SCHOOL BUILDINGS FOR USE IN ALL CLIMATE ZONES**

<b>Roofs/Ceilings</b>		
Roofs of Metal Buildings		Maximum U-factor 0.048
Roofs of all non-Metal Buildings		Maximum U-factor 0.039
Roofing Products – Aged Reflectance/Emittance		
Low-sloped	Low-Sloped	0.63/0.75
Steep-Sloped	Steep-Sloped	0.20/0.75
<b>Walls</b>		
Walls of Wood frame buildings		Maximum U-factor 0.059
Walls of Metal frame buildings		Maximum U-factor 0.062
Walls of Metal buildings		Maximum U-factor 0.057
Walls of Mass/ $7.0 \leq HC$ , any building		Maximum U-factor 0.170
All Other Walls		Maximum U-factor 0.059
<b>Floors and soffits of all buildings</b>		Maximum U-factor 0.048
<b>- Windows of all buildings</b>		
U-factor		Maximum U-factor 0.47
RSHGC		Maximum RSHGC 0.26
Glazed Doors, All Buildings		
Max Average Weighted U-factor		0.45
Max Average Weighted RSHGC		0.23
Exterior Doors, all buildings		
Non-Swinging doors		Maximum U-factor 0.50
Swinging doors		Maximum U-factor 0.70
<b>Skylights</b>		
Glass with Curb		Maximum U-factor 0.99
Glass -without Curb		Maximum U-factor 0.57
Plastic with Curb		Maximum U-factor 0.87
Glass Skylights	0-2% SRR	Maximum SHGC 0.46
	2.1-5% SRR	Maximum SHGC 0.36
Plastic Skylights	0-2% SRR	Maximum SHGC 0.69
	2.1-5% SRR	Maximum SHGC 0.57



# §140.3 and the Plans Examiner

- **Verify specifications on NRCC-ENV-01**
  - Cool Roofs (*Section E*)
  - Air barrier (*Section F*)
  - Windows/skylights (*Section G*)
- **Must match building plans**
  - Footnotes on structural/architectural plans
  - Window Schedule

STATE OF CALIFORNIA  
ENVELOPE COMPONENT APPROACH  
CERTIFICATE OF COMPLIANCE  
NRCC-ENV-01-E  
(Page 2 of 3)

Project Name: 2013 CALBO Training Sample Date Prepared: 01/01/14

E. ROOFING PRODUCTS (COOL ROOF)										
1	2	3	4	Proposed			Minimum Required			11
				5	6	7	8	9	10	
Mass Roof 25 lb ft <sup>2</sup> or greater	Roof Pitch	CRRP Product ID Number	Product Type	Aged Solar Reflectance	Thermal Emittance	SRI <sup>1</sup> (Optional)	Aged Solar Reflectance	Thermal Emittance	SRI (optional)	Comments
<input type="checkbox"/>	2 : 12	0101-2013	Single Ply	<input checked="" type="checkbox"/>	0.65	0.80		0.63	0.75	
<input type="checkbox"/>				<input type="checkbox"/>						
<input type="checkbox"/>				<input type="checkbox"/>						

An aged solar reflectance less than 0.63 is allowed provided the maximum roof/ceiling U-factor in TABLE 140.3 is not exceeded.

High-rise residential buildings and Hotels and Motels with low-sloped roofs in Climate Zones 1 through 8, 12 and 16 are exempted from aged Solar Reflectance and emittance requirements.

High-rise residential buildings and Hotels and Motels with steep-sloped roofs in Climate Zones 1 and 16 are exempt from aged Solar Reflectance and emittance requirements.

The roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are exempt from aged Solar Reflectance and emittance requirements.

To apply Liquid Field Applied Coatings, the coating must be applied across the entire roof surface and meet the dry mil thickness or coverage recommended by the coatings manufacturer and meet minimum performance requirements listed in §110.8(i)4. Select the applicable coating:

Aluminum-Pigmented Asphalt Roof Coating  Cement-Based Roof Coating  Other \_\_\_\_\_

NOTES:  
1. Check the box if the aged solar reflectance was not available in the Cool Roof Rating Council's Rated Product Directory. Then use the equation in Section 110.8(i)2 where the Initial Reflectance value from the same directory and use the equation  $(0.2+R)(P_{max}-0.2)$  to obtain a calculated aged value. Where p is the Initial Solar Reflectance and B is either set to 0.65 for Field-Applied Coatings or it is set to 0.70 for all other roofing products other than Field-Applied Coating.  
2. Calculate the SRI Value by using the SRI-Worksheet at (TBD) and enter the resulting value in the SRI Column above and attach a copy for the SRI-Worksheet NRCC-ENV-03-E to the to this form.

F. Air Barrier				
1	2	3	4	5
Tsg/ID	Air Barrier Material Type	Air Barrier Assembly Type	Whole Building Air Leakage Testing	Comments
1	Sheet steel	Roof		
2	Plywood - 3/8	Walls		

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance June 2013

\* Form must be registered starting 1/1/15

**ENVELOPE COMPONENT APPROACH**

CEC-NRCC-ENV-01-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE

NRCC-ENV-01-E

Envelope Component Approach

(Page 2 of 3)

Project Name: 2013 CALBO Training Sample

Date Prepared: 01/01/14

E. ROOFING PRODUCTS (COOL ROOF)															
1	2	3	4	5			6			7	8		9	10	11
Mass Roof 25 lb ft <sup>2</sup> or greater	Roof Pitch	CRRC Product ID Number	Product Type	Proposed			Minimum Required			SRI <sup>2</sup> (Optional)	Aged Solar Reflectance	Thermal Emittance	SRI (optional)	Comments	
				Aged Solar Reflectance	Thermal Emittance	SRI <sup>2</sup> (Optional)	Aged Solar Reflectance	Thermal Emittance	SRI (optional)						
<input type="checkbox"/>	2 : 12	0101-2013	Single Ply	<input type="checkbox"/> <sup>1</sup>	0.65	0.80					0.63	0.75			
<input type="checkbox"/>				<input type="checkbox"/> <sup>1</sup>											
<input type="checkbox"/>				<input type="checkbox"/> <sup>1</sup>											
<input type="checkbox"/> An aged solar reflectance less than 0.63 is allowed provided the maximum roof / ceiling U-factor in TABLE 140.3 is not exceeded															
<input type="checkbox"/> High-rise residential buildings and Hotels and Motels with low-sloped roofs in Climate Zones 1 through 8, 12 and 16 are exempted from aged Solar Reflectance and emittance requirements.															
<input type="checkbox"/> High-rise residential buildings and Hotels and Motels with steep-sloped roofs in Climate Zones 1 and 16 are exempt from aged Solar Reflectance and emittance requirements.															
<input type="checkbox"/> The roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are exempt from aged Solar Reflectance and emittance requirements															
To apply <b>Liquid Field Applied Coatings</b> , the coating must be applied across the entire roof surface and meet the dry mil thickness or coverage recommended by the coatings manufacturer and meet minimum performance requirements listed in §110.8(i)4. Select the applicable coating:															
<input type="checkbox"/> Aluminum-Pigmented Asphalt Roof Coating			<input type="checkbox"/> Cement-Based Roof Coating			<input type="checkbox"/> Other _____									
<b>NOTES:</b>															
1. Check the box if the aged Solar reflectance was not available in the Cool Roof Rating Council's Rated Product Directory, Then use the equation in Section 110.8(i)2 where the Initial Reflectance value from the same directory and use the equation $(0.2+B(p_{initial} - 0.2))$ to obtain a calculated aged value. Where $p$ is the Initial Solar Reflectance and $B$ is either set to 0.65 for Field-Applied Coatings or it is set to 0.70 for all other roofing products other than Field-Applied Coating.															
2. Calculate the SRI Value by using the SRI-Worksheet at (TBD) and enter the resulting value in the SRI Column above and attach a copy for the SRI-Worksheet NRCC-ENV-03-E to the to this form.															

F. Air Barrier				
1	2	3	4	5
Tag/ID	Air Barrier Material Type	Air Barrier Assembly Type	Whole Building Air Leakage Testing	Comments
1	Sheet steel	Roof		
2	Plywood – 3/8	Walls		

**ENVELOPE COMPONENT APPROACH**

CEC-NRCC-ENV-01-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE

NRCC-ENV-01-E

Envelope Component Approach

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Project Name: 2013 CALBO Training Sample

Date Prepared: 01/01/14

<b>G. FENESTRATION PROPOSED AREAS AND EFFICIENCIES</b>											
1	2	3	4	5	6	7	8	9	10	11	12
Tag/ID	Fenestration Type	Area	Orientation N, S, W, E or Roof	# of Panels	Max U-Factor	Overhang	Max (R)SHGC	Min VT	Label	Conditions Status	Comments
<b>1</b>	<b>Fixed Window</b>	<b>50</b>	<b>North</b>	<b>2</b>	<b>0.35</b>		<b>0.25</b>	<b>0.42</b>	<b>NFRC</b>	<b>New</b>	
<b>2</b>	<b>Operable Window</b>	<b>25</b>	<b>West</b>	<b>2</b>	<b>0.45</b>		<b>0.22</b>	<b>0.32</b>	<b>NFRC</b>	<b>New</b>	

<b>H. ENVELOPE MANDATORY MEASURES</b>	
Indicate location on building plans of Mandatory Envelope Measures Note Block: _____	
<b>INSTRUCTIONS TO APPLICANT ENVELOPE COMPLIANCE &amp; WORKSHEETS (check box if worksheet are included)</b>	
<i>For detailed instructions on the use of this and all Energy Efficiency Standards compliance forms, please refer to the Nonresidential Compliance Manual.</i>	
<input type="checkbox"/>	NRCC-ENV-01-E Certificate of Compliance. Required on plans for all submittals.
<input type="checkbox"/>	NRCC-ENV-04-E Use when minimum skylight requirements for large enclosed spaces are required in climate zones 2 through 15. Optional on plans.

For assistance or questions regarding the Energy Standards, contact the Energy Hotline at: 1-800-772-3300.



## §140.3 and the Plans Examiner *cont.*

- **Other Prescriptive NRCC-ENV forms:**
  - NRCC-ENV-02
    - Fenestration area worksheet
  - NRCC-ENV-03
    - Solar reflectance index (SRI) worksheet
  - NRCC-ENV-04
    - Skylight area worksheet – [§140.3\(c\)](#)
  - NRCC-ENV-05
    - Fenestration default values (§110.6) label
  - NRCC-ENV-06
    - Area weighted average worksheet

(b) **RESERVED**

(c) **Minimum Daylighting Requirement for Large Enclosed Spaces.** In Climate Zones 2 through 15, conditioned enclosed spaces, and unconditioned enclosed spaces, that are greater than 5,000 ft<sup>2</sup> and that are directly under a roof with ceiling heights greater than 15 feet, shall meet the following requirements:

1. A combined total of at least 75percent of the floor area, as determined in building floor plan (drawings) view, shall be within one or more of the following:
  - A. Primary Sidelight Daylight Zone in accordance with Section 130.1(d)1B, or
  - B. Skylit Daylit Zone in accordance with Section 130.1(d)1A.
2. All Skylit Daylit Zones and Primary Sidelit Daylit Zones shall be shown on building plans.
3. General lighting in daylit zones shall be controlled in accordance with Section 130.1(d).
4. Skylights shall:
  - A. Have a glazing material or diffuser that has a measured haze value greater than 90 percent, tested according to ASTM D1003 (notwithstanding its scope) or another test method approved by the Commission; and
  - B. If the space is conditioned, meet the requirements in Section 140.3(a)6.

**EXCEPTION 1 to Section 140.3(c):** Auditoriums, churches, movie theaters, museums, and refrigerated warehouses.

**EXCEPTION 2 to Section 140.3(c):** In buildings with unfinished interiors, future enclosed spaces for which there are plans to have:

- A. A floor area of less than or equal to 5,000 square feet; or
- B. Ceiling heights of less than or equal to 15 feet. This exception shall not be used for S-1 or S-2 (storage), or for F-1 or F-2 (factory) occupancies.

**EXCEPTION 3 to Section 140.3(c):** Enclosed spaces having a designed general lighting system with a lighting power density less than 0.5 watts per square foot.



## §140.3 and the Field Inspector



- **At Rough Frame verify:**
  - Cool roof efficiencies
    - CRRC product label
  - Window/skylight efficiencies
    - NFRC label/certificate
  - Installed continuous air barrier for exterior walls, roofs, ceilings, and raised floors
- **All values must match NRCC-ENV-01 form**



## §140.3 and the Field Inspector *cont.*

- **NRCA-ENV-02 form is req. for site-built fenestration**
  - Field technician verifies U-factor, SHGC, and VT using
    - NFRC label/certificate if certified
    - OR
    - NRCC-ENV-05 form if default values were used

*\* NOTE: Field technician certification is not req. for NRCA-ENV testing*

**FENESTRATION ACCEPTANCE**

CEC-NRCA-ENV-02-F (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF ACCEPTANCE		NRCA-ENV-02-F
Fenestration Acceptance		(Page 1 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

Note: The Enforcement Agency may optionally verify any Fenestration being installed for authenticity by accessing <http://cmast.nfrc.org/Project/CertificateFind.aspx> for NFRC CMAST Certificate Labels or NFRC Certificate Labels <http://search.nfrc.org/search/searchDefault.aspx> See Reference Nonresidential Appendix NA7 for additional information.

**A. BUILDING INFORMATION**

BUILDING TYPE:	<input type="checkbox"/> Low-rise Nonresidential	<input type="checkbox"/> Low-rise Schools	<input type="checkbox"/> High Rise Residential	<input type="checkbox"/> Hotel/Motel Guest Room		
PHASE OF CONSTRUCTION:	<input type="checkbox"/> New Building Construction		<input type="checkbox"/> Addition	<input type="checkbox"/> Alteration		
TYPE OF LABEL CERTIFICATE:	<input type="checkbox"/> Rated <b>NFRC</b> Component Modeling Approach (CMA) Label Certificate or <b>NFRC</b> Certified Label		<input type="checkbox"/> <b>NRCC-ENV-05-E - FC-1</b> for Nonrated Fenestration Values < 1,000 ft <sup>2</sup>	<input type="checkbox"/> <b>NRCC-ENV-05-E - FC-1</b> for Nonrated Fenestration Values ≥ 1,000 ft <sup>2</sup>		
TYPE OF INSTALLED FENESTRATION:	<input type="checkbox"/> Vertical Fenestration	<input type="checkbox"/> Tubular Daylighting Device (TDD)	<input type="checkbox"/> Skylight	<input type="checkbox"/> Dynamic Glazing	<input type="checkbox"/> Window Film	<input type="checkbox"/> Block Glass

**B. STATEMENT OF ACCEPTANCE**

This Certificate of Acceptance summarizes the results of the Acceptance test as specified in the Reference Nonresidential Appendix, NA7.4. Additional related references are in Sections §10-103(a)4, §10-111, §116(a)5 of the Energy Efficiency Standards.

**SUMMARY OF FENESTRATION VERIFICATION AND INSPECTION BY RESPONSIBLE PARTY**

Individuals who perform the field testing and verification work, and provide the information required for completion of the Certificate of Acceptance documentation are not required to be licensed professionals. However, the person who signs the Certificate of Acceptance document to certify compliance with the acceptance requirements shall be licensed as specified in Standards Section 10-103(a)4 and NA7.3.1.

The Responsible Person or Party shall verify the thermal performance (U-factor, SHGC and VT) of each specified fenestration product being installed matches the fenestration the NFRC Label Certificate, the CEC energy compliance documentation and building plans. Note: A maximum of 4 NFRC Product Listings for each Certificate of Acceptance.

**For NFRC Rated Product (If more than 8 fenestration products use additional sheets)**

If Product is rated by NFRC then enter the ID # in each column. This includes any of the types of installed fenestration listed above.	1	2	3	4
	NFRC Label Certificate ID #			
	5	6	7	8
	NFRC Label Certificate ID #			

**For Nonrated Fenestration Attach a copy of the NRCC-ENV-05-E (previously known as FC-1)**

<b>For All Fenestration: Verify and Cross Reference:</b>				
	1	2	3	4
If receipts or orders are available and it identifies the NFRC ID# then cross reference against the NFRC Label Certificate to match ID#s; or	<input type="checkbox"/> Delivery Receipt(s) <input type="checkbox"/> Purchase Order or <input type="checkbox"/> Detailed Receipt	<input type="checkbox"/> Delivery Receipt(s) <input type="checkbox"/> Purchase Order or <input type="checkbox"/> Detailed Receipt	<input type="checkbox"/> Delivery Receipt(s) <input type="checkbox"/> Purchase Order or <input type="checkbox"/> Detailed Receipt	<input type="checkbox"/> Delivery Receipt(s) <input type="checkbox"/> Purchase Order or <input type="checkbox"/> Detailed Receipt
Cross reference the efficiencies listed on the NFRC Label Certificate of <b>NRCC-ENV-05-E - FC-1</b> matches the building plans window schedule of efficiencies.	<input type="checkbox"/> Cross Reference and Matches Building Plans	<input type="checkbox"/> Cross Reference and Matches Building Plans	<input type="checkbox"/> Cross Reference and Matches Building Plans	<input type="checkbox"/> Cross Reference and Matches Building Plans



CERTIFICATE OF COMPLIANCE	NRCC-ENV-05-E
Fenestration Certificate Label	(Page 1 of 2)
Project Name:	Date Prepared:

*This form is only used when an NFRC Label Certificate is not available. A separate (NCRCC-ENV-05-E formally FC-1) Label Certificate Form is required for each different fenestration product or different types of Fenestration.*

*Method 1: For buildings with **less** than 1,000 ft<sup>2</sup> of site-built fenestration may optionally use either CEC Default Tables 110.6-A and 110.6-B, **Method 1**, or the Alternative Calculation Nonresidential Reference Appendix NA6, **Method 2**. Enter the total U-factor<sub>T</sub>, SHGC<sub>T</sub> and VT<sub>T</sub> (Optional) in the following boxes below.*

*Method 2: For buildings with **greater** 1,000 ft<sup>2</sup> of site-built fenestration without NFRC Label Certificate, only one option is available; use CEC Default Tables 110.6-A and 110.6-B. Use **Method 1** only below and enter the total U-factor<sub>T</sub>, SHGC<sub>T</sub> and VT<sub>T</sub> in the following boxes below.*

**A. GENERAL INFORMATION**

1	Climate Zone:		
2	Total Number of like Fenestration products:		
3	Total square footage of like Fenestration:		

**B. METHOD 1****U-FACTOR INFORMATION** from default, See TABLE 110.6-A

1	Frame Type:	<input type="checkbox"/> Metal	<input type="checkbox"/> Metal With Thermal Break	<input type="checkbox"/> Nonmetal		
2	Product Type:	<input type="checkbox"/> Operable	<input type="checkbox"/> Fixed	<input type="checkbox"/> Greenhouse/Garden Window	<input type="checkbox"/> Doors	<input type="checkbox"/> Skylights
3	Glazing Type:	<input type="checkbox"/> Single Pane	<input type="checkbox"/> Double Pane	<input type="checkbox"/> Glass Block		
4	Enter the appropriate value from Table 110.6-A					<b>U-factor<sub>T</sub> =</b>

**SOLAR HEAT GAIN COEFFICIENT INFORMATION** from default, See TABLE 110.6-B

5	Product Type:	<input type="checkbox"/> Operable	<input type="checkbox"/> Fixed	
6	Glazing:	<input type="checkbox"/> Clear	<input type="checkbox"/> Tinted	
7	Enter the appropriate value from Table 110.6-B			<b>SHGC<sub>T</sub> =</b>

**VISIBLE TRANSMITTANCE** from Reference Nonresidential Appendix NA6

8	Product Type:	<input type="checkbox"/> Casement/Awning <input type="checkbox"/> Sliding <input type="checkbox"/> Fixed	<input type="checkbox"/> Curtainwall/Storefront/Site-built Manufactured Skylights(Non-curb mounted)	<input type="checkbox"/> Skylights Manufactured (Curb Mounted)	
9	Enter Center-of-Glass for VT <sub>C</sub> value:				<b>VT<sub>C</sub> =</b>
10	Calculate VT <sub>T</sub> = VT <sub>F</sub> x VT <sub>C</sub> (See Equation NA6-3)				<b>VT<sub>T</sub> =</b>

**C. METHOD 2***Alternative Calculation Nonresidential Reference Appendix NA6*

NA6 Default Calculation - Enter Center of Glass (COG) value from Manufacturer's Documentation below:				Calculated Values	
1	STEP 1: Enter Center-of-Glass for U-factor <sub>C</sub> or the U <sub>C</sub> value:		4	STEP 4: U-factor <sub>T</sub> = C <sub>1</sub> + (C <sub>2</sub> X U <sub>C</sub> )	<b>U-factor<sub>T</sub> =</b>
2	STEP 2: Enter Center-of-Glass for SHGC <sub>C</sub> value:		5	STEP 5: SHGC <sub>T</sub> = 0.08 + (0.86 x SHGC <sub>C</sub> ) (See Equation NA6-2)	<b>SHGC<sub>T</sub> =</b>
3	STEP 3: Enter Center-of-Glass for VT <sub>C</sub> value:		6	STEP 6: VT <sub>T</sub> = VT <sub>F</sub> x VT <sub>C</sub> (See Equation NA6-3)	<b>VT<sub>T</sub> =</b>

**D. ATTACHED MANUFACTURER'S LITERATURE**

1	Manufacturer's literature must match the Product Type, Frame Type, Glazing, Center-of- Glass (COG) U-factor <sub>C</sub> , SHGC <sub>C</sub> and VT <sub>C</sub> information needed to calculate the Default U-factor <sub>T</sub> , SHGC <sub>T</sub> , and VT <sub>T</sub> .
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# HVAC

## 2008 – §144

- Loads calcs./sizing
- Economizers req. when fan capacity > 2,500 cfm, and HVAC capacity > 75,000 Btu/hr
- Air-cooled chillers limited to 100 tons when water plant capacity > 300 tons
- Duct leakage testing

## 2013 – §140.4

- Economizer reqs. updated
  - Req. when HVAC capacity > 54,000 Btu/hr
  - Fan capacity criteria removed
  - Economizer trade-offs revised in [TABLE 140.4-A](#)
  - [Performance](#) reqs. for economizers > 45,000 Btu/hr
- Air-cooled chiller limitation lifted to 300 tons regardless of water plant size

**TABLE 140.4-A ECONOMIZER TRADE-OFF TABLE FOR COOLING SYSTEMS**

<b>Climate Zone</b>	<b>Efficiency Improvement <sup>a</sup></b>
1	70%
2	65%
3	65%
4	65%
5	70%
6	30%
7	30%
8	30%
9	30%
10	30%
11	30%
12	30%
13	30%
14	30%
15	30%
16	70%

<sup>a</sup> If a unit is rated with an IPLV, IEER or SEER, then to eliminate the required air or water economizer, the applicable minimum cooling efficiency of the HVAC unit must be increased by the percentage shown. If the HVAC unit is only rated with a full load metric, such as EER or COP cooling, then that metric must be increased by the percentage shown.

TABLE 140.4-B AIR ECONOMIZER HIGH LIMIT SHUT OFF CONTROL REQUIREMENTS

Device Type <sup>a</sup>	Climate Zones	Required High Limit (Economizer Off When):	
		Equation <sup>b</sup>	Description
Fixed Dry Bulb	1, 3, 5, 11-16	$T_{OA} > 75^{\circ}\text{F}$	Outdoor air temperature exceeds 75°F
	2, 4, 10	$T_{OA} > 73^{\circ}\text{F}$	Outdoor air temperature exceeds 73°F
	6, 8, 9	$T_{OA} > 71^{\circ}\text{F}$	Outdoor air temperature exceeds 71°F
	7	$T_{OA} > 69^{\circ}\text{F}$	Outdoor air temperature exceeds 69°F
Differential Dry Bulb	1, 3, 5, 11-16	$T_{OA} > T_{RA}^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature
	2, 4, 10	$T_{OA} > T_{RA}-2^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 2°F
	6, 8, 9	$T_{OA} > T_{RA}-4^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 4°F
	7	$T_{OA} > T_{RA}-6^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 6°F
Fixed Enthalpy <sup>c</sup> + Fixed Drybulb	All	$h_{OA} > 28 \text{ Btu/lb}^{\circ}$ or $T_{OA} > 75^{\circ}\text{F}$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air <sup>c</sup> or Outdoor air temperature exceeds 75°F

<sup>a</sup> Only the high limit control devices listed are allowed to be used and at the setpoints listed. Others such as Dew Point, Fixed Enthalpy, Electronic Enthalpy, and Differential Enthalpy Controls, may not be used in any Climate Zone for compliance with Section 140.4(e)1 unless approval for use is provided by the Energy Commission Executive Director.

<sup>b</sup> Devices with selectable (rather than adjustable) setpoints shall be capable of being set to within 2°F and 2 Btu/lb of the setpoint listed.

<sup>c</sup> At altitudes substantially different than sea level, the Fixed Enthalpy limit value shall be set to the enthalpy value at 75°F and 50% relative humidity. As an example, at approximately 6,000 foot elevation, the fixed enthalpy limit is approximately 30.7 Btu/lb.

4. If an economizer is required by Section 140.4(e)1, and an air economizer is used to meet the requirement, then the air economizer, and all return air dampers on any individual cooling fan system that has a total mechanical cooling capacity over 45,000 Btu/hr shall have the following features:
  - A. **Warranty.** 5-year Manufacturer warranty of economizer assembly.
  - B. **Damper reliability testing.** Suppliers of economizers shall certify that the economizer assembly, including but not limited to outdoor air damper, return air damper, drive linkage, and actuator, have been tested and are able to open and close against the rated airflow and pressure of the system after 60,000 damper opening and closing cycles.
  - C. **Damper leakage.** Economizer and return dampers shall be certified in accordance with AMCA Publication 500 to have a maximum leakage rate of 10 cfm/sf at 1.0 in. w.g.
  - D. **Adjustable setpoint.** If the high-limit control is fixed dry-bulb or fixed enthalpy + fixed dry-bulb then the control shall have an adjustable setpoint.
  - E. **Sensor accuracy.** Outdoor air, return air, mixed air, and supply air sensors shall be calibrated within the following accuracies.
    - i. Drybulb and wetbulb temperatures accurate to ±2°F over the range of 40°F to 80°F.
    - ii. Enthalpy accurate to ±3 Btu/lb over the range of 20 Btu/lb to 36 Btu/lb.
    - iii. Relative humidity (RH) accurate to ±5 percent over the range of 20percent to 80 percent RH.
  - F. **Sensor calibration data.** Data used for control of the economizer shall be plotted on a sensor performance curve.

- G. **Sensor high limit control.** Sensors used for the high limit control shall be located to prevent false readings, including but not limited to being properly shielded from direct sunlight.
  - H. **Relief air system.** Relief air systems shall be capable of providing 100 percent outside air without over-pressurizing the building.
5. Systems that include an air economizer to meet Section 140.4(e)1 shall include the following:
- A. Unit controls shall have mechanical capacity controls interlocked with economizer controls such that the economizer is at 100 percent open position when mechanical cooling is on and does not begin to close until the leaving air temperature is less than 45°F.
  - B. Direct Expansion (DX) units that control the capacity of the mechanical cooling directly based on occupied space temperature shall have a minimum of 2 stages of mechanical cooling capacity, per the following effective dates:
    - i.  $\geq 75,000$  Btu/hr – Effective 1/1/2014
    - ii.  $\geq 65,000$  Btu/hr – Effective 1/1/2016
  - C. Effective 1/1/2014, DX units not within the scope of Section 140.4(e)5,B, such as those that control space temperature by modulating the airflow to the space, shall (i) comply with the requirements in TABLE 140.4-C, and (ii) shall have controls that do-not false load the mechanical cooling system by limiting or disabling the economizer or by any other means, such as hot gas bypass, except at the lowest stage of mechanical cooling capacity.

*TABLE 140.4-C DIRECT EXPANSION (DX) UNIT REQUIREMENTS FOR COOLING STAGES AND COMPRESSOR DISPLACEMENT*

<b>Cooling Capacity</b>	<b>Minimum Number of Mechanical Cooling Stages</b>	<b>Minimum Compressor Displacement</b>
$\geq 65,000$ Btu/h and $< 240,000$ Btu/h	3 stages	$\leq 35\%$ full load
$\geq 240,000$ Btu/h	4 stages	$\leq 25\%$ full load

- (f) **Supply Air Temperature Reset Controls.** Space-conditioning systems supplying heated or cooled air to multiple zones shall include controls that automatically reset supply-air temperatures. Air distribution systems serving zones that are likely to have constant loads, such as interior zones, shall be designed for the air flows resulting from the fully reset supply air temperature. Supply air temperature reset controls shall be:
1. In response to representative building loads or to outdoor air temperature; and
  2. At least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

**EXCEPTION 1 to Section 140.4(f):** Systems that meet the requirements of Section 140.4(d), without using Exception 1 or 2 to that section.

**EXCEPTION 2 to Section 140.4(f):** Where supply-air temperature reset would increase overall building energy use.

**EXCEPTION 3 to Section 140.4(f):** Systems supplying zones in which specific humidity levels are required to satisfy exempt process loads. Computer Rooms or other spaces with only IT equipment may not use this exception.

- (g) **Electric Resistance Heating.** Electric resistance heating systems shall not be used for space heating.

**EXCEPTION 1 to Section 140.4(g):** Where an electric-resistance heating system supplements a heating system in which at least 60 percent of the annual energy requirement is supplied by site-solar or recovered energy.



# §140.4 and the Plans Examiner

STATE OF CALIFORNIA HVAC SYSTEM REQUIREMENTS CEC-NRCC-MCH-02-E (Revised 06/13)		CALIFORNIA ENERGY COMMISSION		
CERTIFICATE OF COMPLIANCE		NRCC-MCH-02-E		
HVAC Dry System Requirements		(Page 1 of 3)		
Project Name: 2013 CALBO Training Seminar		Date Reported: 01/01/14		
Equipment Tags and System Description <sup>1</sup>	T-24 Sections	HVAC-1		
<b>MANDATORY MEASURES</b>				
Heating Equipment Efficiency <sup>2</sup>	110.1 or 110.2(a)	100,000 btu/hr		
Cooling Equipment Efficiency <sup>2</sup>	110.1 or 110.2(a)	5 ton		
HVAC or Heat Pump Thermostats	110.2(b), 110.2(c)	M.1 (note block)		
Furnace Standby Loss Control	110.2(d)	M.1 (note block)		
Low leakage AHUs	110.2(f)	M.1 (note block)		
Ventilation <sup>3</sup>	120.1(b)	M.2 (schedule)		
Demand Control Ventilation <sup>3</sup>	120.1(c)(4)	N/A		
Occupant Sensor Ventilation Control <sup>4</sup>	120.1(c)(5), 120.2(e)(3)	N/A		
Shutoff and Reset Controls <sup>7</sup>	120.2(e)	M.1 (note block)		
Outdoor Air and Exhaust Damper Control	120.2(f)	M.1 (note block)		
Isolation Zones	120.2(g)	M.1 (note block)		
Automatic Demand Shed Controls	120.2(h)	N/A		
Economizer FDD	120.2(i)	N/A		
Duct Insulation	120.4	R-8		
<b>PRESCRIPTIVE MEASURES</b>				
Equipment is sized in conformance with 140.4 (a & b)	140.4(a & b)	Y/N	Y/N	Y/N
Supply Fan Pressure Control	140.4(c)	N		
Simultaneous Heat/Cool <sup>8</sup>	140.4(d)	N		
Economizer	140.4(e)	Y (M.3 schedule)		
Heat and Cool Air Supply Reset	140.4(f)	N		
Electric Resistance Heating <sup>9</sup>	140.4(g)	N		
Duct Leakage Sealing and Testing <sup>10</sup>	140.4(l)	Y (HERS)		

**Notes:**

- Provide equipment tags (e.g. AHU 1 to 10) and system description (e.g. Single Duct VAV reheat) as appropriate. Multiple units with common requirements can be grouped together.
- Provide references to plans (i.e. Drawing Sheet Numbers) and/or specifications (including Section name/number and relevant paragraphs) where each requirement is specified. Enter "N/A" if the requirement is not applicable to this system.
- The referenced plans and specifications must include all of the following information: equipment tag, equipment nominal capacity, Title 24 minimum efficiency requirements, and actual rated equipment efficiencies. Where multiple efficiency requirements are applicable (e.g. full- and part-load) include all. Where appliance standards apply (110.1), identify where equipment is required to be listed per Title 20 1601 et seq.
- Identify where the ventilation requirements are documented for each central HVAC system. Include references to both central unit schedules and sequences of operation. If one or more space is naturally ventilated identify where this is documented in the plans and specifications. Multiple zone central air systems must also provide a MCH-03-E form.
- If one or more space has demand controlled ventilation identify where it is specified including the sensor specifications and the sequence of operation.
- If one or more space has occupant sensor ventilation control identify where it is specified including the sensor specifications and the sequence of operation.
- If the system is DDC identify the sequences for the system start/stop, optimal start, setback (if required) and setup (if required). For all systems identify the specification for the thermostats and time clocks (if applicable).
- Identify where the heating, cooling and deadband airflows are scheduled for this system. Include a reference to the specification of the zone controls. Provide a MCH-03-E form.
- Enter N/A if there is no electric heating. If the system has electric heating indicate which exception to 140.4(g) applies.
- If duct leakage sealing and testing is required, a MCH-04-A form must be submitted.

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance June 2013

- **Verify on NRCC-MCH-02**
  - Specifications for economizers when req. (*Page 1*)
  - Specifications for air-cooled chillers when applicable (*Page 2*)
  - Form should cite building plans reference
    - Mechanical schedule, note block, etc.
- **Forms must be registered starting 1/1/15**



CERTIFICATE OF COMPLIANCE		NRCC-MCH-02-E
HVAC Dry System Requirements		(Page 1 of 3)
Project Name: 2013 CALBO Training Sample	Date Prepared: 01/01/14	

Equipment Tags and System Description <sup>1</sup>		HVAC-1		
<b>MANDATORY MEASURES</b>	<b>T-24 Sections</b>	<b>Reference to the Requirements in the Contract Documents<sup>2</sup></b>		
Heating Equipment Efficiency <sup>3</sup>	110.1 or 110.2(a)	100,000 btu/hr		
Cooling Equipment Efficiency <sup>3</sup>	110.1 or 110.2(a)	5 ton		
HVAC or Heat Pump Thermostats	110.2(b), 110.2(c)	M.1 (note block)		
Furnace Standby Loss Control	110.2(d)	M.1 (note block)		
Low leakage AHUs	110.2(f)	M.1 (note block)		
Ventilation <sup>4</sup>	120.1(b)	M.2 (schedule)		
Demand Control Ventilation <sup>5</sup>	120.1(c)4	N/A		
Occupant Sensor Ventilation Control <sup>6</sup>	120.1(c)5, 120.2(e)3	N/A		
Shutoff and Reset Controls <sup>7</sup>	120.2(e)	M.1 (note block)		
Outdoor Air and Exhaust Damper Control	120.2(f)	M.1 (note block)		
Isolation Zones	120.2(g)	M.1 (note block)		
Automatic Demand Shed Controls	120.2(h)	N/A		
Economizer FDD	120.2(i)	N/A		
Duct Insulation	120.4	R-8		
<b>PRESCRIPTIVE MEASURES</b>				
Equipment is sized in conformance with 140.4 (a & b)	140.4(a & b)	Y/N	Y/N	Y/N
Supply Fan Pressure Control	140.4(c)	N		
Simultaneous Heat/Cool <sup>8</sup>	140.4(d)	N		
Economizer	140.4(e)	Y (M.3 schedule)		
Heat and Cool Air Supply Reset	140.4(f)	N		
Electric Resistance Heating <sup>9</sup>	140.4(g)	N		
Duct Leakage Sealing and Testing. <sup>10</sup>	140.4(l)	Y (HERS)		
<b>Notes:</b>				
<ol style="list-style-type: none"> <li>Provide equipment tags (e.g. AHU 1 to 10) and system description (e.g. Single Duct VAV reheat) as appropriate. Multiple units with common requirements can be grouped together.</li> <li>Provide references to plans (i.e. Drawing Sheet Numbers) and/or specifications (including Section name/number and relevant paragraphs) where each requirement is specified. Enter "N/A" if the requirement is not applicable to this system.</li> <li>The referenced plans and specifications must include all of the following information: equipment tag, equipment nominal capacity, Title 24 minimum efficiency requirements, and actual rated equipment efficiencies. Where multiple efficiency requirements are applicable (e.g. full- and part-load) include all. Where appliance standards apply (110.1), identify where equipment is required to be listed per Title 20 1601 et seq.</li> <li>Identify where the ventilation requirements are documented for each central HVAC system. Include references to both central unit schedules and sequences of operation. If one or more space is naturally ventilated identify where this is documented in the plans and specifications. Multiple zone central air systems must also provide a MCH-03-E form.</li> <li>If one or more space has demand controlled ventilation identify where it is specified including the sensor specifications and the sequence of operation.</li> <li>If one or more space has occupant sensor ventilation control identify where it is specified including the sensor specifications and the sequence of operation</li> <li>If the system is DDC identify the sequences for the system start/stop, optimal start, setback (if required) and setup (if required). For all systems identify the specification for the thermostats and time clocks (if applicable).</li> <li>Identify where the heating, cooling and deadband airflows are scheduled for this system. Include a reference to the specification of the zone controls. Provide a MCH-03-E form.</li> <li>Enter N/A if there is no electric heating. If the system has electric heating indicate which exception to 140.4(g) applies.</li> <li>If duct leakage sealing and testing is required, a MCH-04-A form must be submitted.</li> </ol>				

# HVAC WET SYSTEM REQUIREMENTS



CERTIFICATE OF COMPLIANCE	NRCC-MCH-02-E
HVAC Wet System Requirements	(Page 2 of 3)
Project Name:	Date Prepared:

Equipment Tags and System Description <sup>1</sup>	T-24 Sections	Chiller 1	Reference to the Requirements in the Contract Documents <sup>2</sup>	
<b>MANDATORY MEASURES</b>				
Heating Hot Water Equipment Efficiency <sup>3</sup>	110.1			
Cooling Chilled and Condenser Water Equipment Efficiency <sup>3</sup>	110.1, 140.4(i)	<b>M.1 (note block)</b>		
Open and Closed Circuit Cooling Towers conductivity or flow-based controls	110.2(e) 1	<b>M.1 (note block)</b>		
Open and Closed Circuit Cooling Towers Maximum Achievable Cycles of Concentration (LSI) <sup>6</sup>	110.2(e) 2	<b>M.1 (note block)</b>		
Open and Closed Circuit Cooling Towers Flow Meter with analog output	110.2(e) 3	<b>M.1 (note block)</b>		
Open and Closed Circuit Cooling Towers Overflow Alarm	110.2(e) 4	<b>M.1 (note block)</b>		
Open and Closed Circuit Cooling Towers Efficient Drift Eliminators	110.2(e) 5	<b>M.1 (note block)</b>		
Pipe Insulation	120.3	<b>2.0 in.</b>		
<b>PRESCRIPTIVE MEASURES</b>				
Cooling Tower Fan Controls	140.4(h)2, 140.4(h)5	Y/N	Y/N	Y/N
Cooling Tower Flow Controls	140.4(h)3	<b>Y (note block)</b>		
Centrifugal Fan Cooling Towers <sup>4</sup>	140.4(h)4	<b>Y (note block)</b>		
Air-Cooled Chiller Limitation <sup>5</sup>	140.4(j)	<b>Y - 250 tons</b>		
Variable Flow System Design	140.4(k)	<b>N</b>		
Chiller and Boiler Isolation	140.4(k)	<b>Y (note block)</b>		
CHW and HHW Reset Controls	140.4(k)	<b>N</b>		
WLHP Isolation Valves	140.4(k)	<b>N</b>		
VSD on CHW, CW & WLHP Pumps >5HP	140.4(k)	<b>N</b>		
DP Sensor Location	140.4(k)	<b>N</b>		
<b>Notes:</b>				
<ol style="list-style-type: none"> <li>1. Provide equipment tags (e.g. CH 1 to 3) or system description (e.g. CHW loop) as appropriate. Multiple units with common requirements can be grouped together.</li> <li>2. Provide references to plans (i.e. Drawing Sheet Numbers) and/or specifications (including Section name/number and relevant paragraphs) where each requirement is specified. Enter "N/A" if the requirement is not applicable to this system.</li> <li>3. The referenced plans and specifications must include all of the following information: equipment tag, equipment nominal capacity, Title 24 minimum efficiency requirements, and actual rated equipment efficiencies. Where multiple efficiency requirements are applicable (e.g. full- and part-load) include all. For chillers operating at non-standard efficiencies provide the Kadj values. For chillers also note whether the efficiencies are Path A or Path B.</li> <li>4. Identify if cooling towers have propeller fans. If towers use centrifugal fans document which exception is used.</li> <li>5. If air-cooled chillers are used, document which exceptions have been used to comply with 140.4(j) and the total installed design capacity of the air-cooled chillers in the chilled water plant.</li> <li>6. Identify the existence of a completed MCH-06-E \when open or closed circuit cooling towers are specified to be installed, otherwise enter "N/A".</li> </ol>				



## §140.4 and the Plans Examiner *cont.*

- **Other Prescriptive NRCC-MCH forms:**
  - NRCC-MCH-01
    - Identifies req. NRCC and NRCA forms
  - NRCC-MCH-03
    - Ventilation and reheat
  - NRCC-MCH-05
    - Packaged, single zone units
  - NRCC-MCH-06
    - Maximum cycles worksheet



## §140.4 and the Field Inspector

- **At Final verify**
  - Economizer installed when req.
    - Economizer is certified to CEC when  $> 45,000$  Btu/hr
    - [NRCA-MCH-05](#) form
      - ✓ Must be signed by CMATT when req.
      - ✓ Must be registered starting 1/1/15
  - Air-cooled chiller capacity does not exceed 300 tons



**AIR ECONOMIZER CONTROLS ACCEPTANCE**

CEC-NRCA-MCH-05-A (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF ACCEPTANCE		NRCA-MCH-05-A
Air Economizer Controls Acceptance		(Page 1 of 3)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

<i>Note: Submit one Certificate of Acceptance for each system that must demonstrate compliance.</i>	Enforcement Agency Use: Checked by/Date
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<b>A. Construction Inspection</b>
<p>1. Supporting documentation needed to perform test includes:</p> <ol style="list-style-type: none"> <li>2013 Building Energy Efficiency Standards Nonresidential Compliance Manual (<i>NA7.5.4 Air Economizer Controls Acceptance At-A-Glance</i>).</li> <li>2013 Building Energy Efficiency Standards.</li> </ol>
<p>2. Instrumentation to perform test includes:</p> <ol style="list-style-type: none"> <li>Hand-held temperature probe Calibration Date: <u>1/1/14</u> (must be within last year)</li> <li>Meter capable of measuring enthalpy Calibration Date: <u>1/1/14</u> (must be within last year)</li> <li>1.2 k Ohm Resistor (for standalone package systems, i.e. non-DDC controls)</li> </ol>
<p>3. Installation: (<b>all</b> of the following boxes should be checked)</p> <p><input checked="" type="checkbox"/> Economizer lockout setpoint complies with Table 140.4-B found in the 2013 Building Energy Efficiency Standards Section 140.4(e)3.</p> <p><input checked="" type="checkbox"/> Economizer reliability features are present per 2013 Building Energy Efficiency Standards Section 140.4(e)4:</p> <ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> A. 5-year manufacturer warranty of economizer assembly</li> <li><input checked="" type="checkbox"/> B. Provide a product specification sheet proving capability of at least 60,000 actuations</li> <li><input checked="" type="checkbox"/> C. Provide a product specification sheet proving economizer damper sections are certified by AMCA 511 for a maximum damper leakage rate of 10 cfm/sf at 1.0 in. w.g. (Class 1A, 1, and 2 are acceptable)</li> <li><input checked="" type="checkbox"/> D. If the high limit setpoint is fixed dry-bulb or fixed enthalpy + fixed dry-bulb then the control shall have an adjustable setpoint</li> <li><input checked="" type="checkbox"/> E. Outdoor air, return air, mixed air, and supply air sensors shall be calibrated as follows: <ol style="list-style-type: none"> <li>Drybulb and wetbulb temperatures accurate to <math>\pm 2^\circ\text{F}</math> over the range of 40°F to 80°F</li> <li>Enthalpy accurate to <math>\pm 3</math> Btu/lb over the range of 20 Btu/lb to 36 Btu/lb</li> <li>Relative humidity (RH) accurate to <math>\pm 5\%</math> over the range of 20% to 80% RH</li> </ol> </li> <li><input checked="" type="checkbox"/> F. Check that the sensor performance curve(s) is provided by the factory and sensor output values measured during sensor calibration are plotted on the performance curve(s)</li> <li><input checked="" type="checkbox"/> G. Sensors used for high limit control shall be located to prevent false readings, including but not limited to being properly shielded from direct sunlight.</li> </ol> <p><input checked="" type="checkbox"/> For DX package units 65,000 Btu/hr or less, verify that a two-stage thermostat is used, and the system is wired so the economizer is the first stage of cooling and the compressor is the second stage</p> <p><input checked="" type="checkbox"/> Unitary systems with an economizer have control systems, including two-stage or electronic thermostats, that cycle compressors off when economizers can provide partial cooling</p> <p><input checked="" type="checkbox"/> System has return fan speed control, relief dampers, or dedicated relief fans to prevent building over pressurization in full economizer mode.</p> <p><input checked="" type="checkbox"/> For systems with DDC controls, sensor used for economizer lockout has been factory or field calibrated.</p> <p><input checked="" type="checkbox"/> For systems with non-DDC controls, manufacturer's startup and testing procedures have been applied.</p>

# AIR ECONOMIZER CONTROLS ACCEPTANCE



CERTIFICATE OF ACCEPTANCE		NRCA-MCH-05-A
Air Economizer Controls Acceptance		(Page 2 of 3)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

B. Functional Testing	Results
<b>Step 1: Disable demand control ventilation systems (if applicable)</b>	
<b>Step 2: Enable the economizer and simulate a cooling demand large enough to drive the economizer fully open.</b> Verify the following:	
a. Economizer damper modulates 100% open.	(Y) N
b. Return air damper modulates 100% closed.	(Y) N
c. For systems that meet the criteria of 2013 Building Energy Efficiency Standards Section 140.4(e)1, verify that the economizer remains 100% open with the use of mechanical cooling. This occurs when the cooling demand can no longer be met by the economizer alone.	(Y) N
d. All applicable fans and dampers operate as intended to maintain building pressure.	(Y) N
e. The unit heating is disabled (if applicable).	Y / N (NA)
<b>Step 3: Disable the economizer and simulate a cooling demand.</b> Verify the following:	
a. Economizer damper closes to its minimum position.	(Y) N
b. All applicable fans and dampers operate as intended to maintain building pressure.	(Y) N
c. The unit heating is disabled (if applicable).	Y / N (NA)
<b>Step 4: If the unit is equipped with heating, simulate a heating demand and enable the economizer.</b> Verify the following:	
a. Economizer damper closes to its minimum position.	Y / N (NA)
b. Return air damper opens.	Y / N (NA)
<b>Step 5: Turn off the unit and verify the following:</b>	
a. Economizer damper closes completely.	(Y) N
<b>Step 6: System returned to initial operating conditions</b>	
	(Y) N

C. Testing Results	PASS / FAIL
Step 2: Simulate cooling load and enable the economizer (all answers are Y).	Pass
Step 3: Simulate cooling load and disable the economizer (all answers are Y).	Pass
Step 4: Simulate heating demand and enable the economizer (all answers are Y).	Pass
Step 5: Turn off the unit (all answers are Y).	Pass

<b>D. Evaluation :</b>
<input checked="" type="checkbox"/> PASS: All <b>Construction Inspection</b> responses are complete and all <b>Testing Results</b> responses are "Pass"

<b>Notes:</b>



## §140.4 and the Plans Examiner *cont.*

- **Required NRCA-MCH forms/testing must be verified before final occupancy permit is issued**
  - Refer to [NRCC-MCH-01](#) form
- **Frequently req. test include:**
  - Outdoor air ventilation (NRCA-MCH-02)
  - Single zone unitary A/C and HP controls (NRCA-MCH-03)
  - Duct leakage (NRCA-MCH-04) – *does not req. CMATT*
    - NRCV-MCH-04 req. (HERS rater test)
  - DCV (NRCA-MCH-06)

<b>CERTIFICATE OF COMPLIANCE</b>	<b>NRCC-MCH-01-E</b>
Mechanical Systems	(Page 1 of 4)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>

**MECHANICAL COMPLIANCE FORMS & WORKSHEETS (check box if worksheet is included)**

*For detailed instructions on the use of this and all Energy Efficiency Standards compliance forms, refer to the 2013 Nonresidential Manual  
 Note: The Enforcement Agency may require all forms to be incorporated onto the building plans.*

YES	NO	Form/Worksheet #	Title
<input checked="" type="checkbox"/>	<input type="checkbox"/>	NRCC-MCH-01E (Part 1 of 3)	Certificate of Compliance, Declaration. Required on plans for all submittals.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	NRCC-MCH-01E (Part 2 of 3)	Certificate of Compliance, Required Acceptance Tests (MCH-02A to 11A). Required on plans for all submittals.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	NRCC-MCH-01E (Part 3 of 3)	Certificate of Compliance, Required Acceptance Tests (MCH-12A to 18A). Required on plans where applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	NRCC-MCH-02E (Part 1 of 2)	Mechanical Dry Equipment Summary is required for all submittals with Central Air Systems. It is optional on plans.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	NRCC-MCH-02E (Part 2 of 2)	Mechanical Wet Equipment Summary is required for all submittals with chilled water, hot water or condenser water systems. It is optional on plans.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	NRCC-MCH-03E	Mechanical Ventilation and Reheat is required for all submittals with multiple zone heating and cooling systems. It is optional on plans.

**MECHANICAL HVAC ACCEPTANCE FORMS (check box for required forms)**

**Designer:**  
*This form is to be used by the designer and attached to the plans. Listed below are all the acceptance tests for HVAC systems. The designer is required to check the applicable boxes for all acceptance tests that apply and list all equipment that requires an acceptance test. All equipment of the same type that requires a test, list the equipment description and the number of systems.*

**Installing Contractor:**  
 The contractor who installed the equipment is responsible to either conduct the acceptance test them self or have a qualified entity run the test for them. If more than one person has responsibility for the acceptance testing, each person shall sign and submit the Certificate of Acceptance applicable to the portion of the construction or installation for which they are responsible.

**Enforcement Agency:**  
*Plancheck – The NRCC-MCH-01-E form is not considered a completed form and is not to be accepted by the building department unless the correct boxes are checked.  
 Inspector - Before occupancy permit is granted all newly installed process systems must be tested to ensure proper operations.*

Test Description		MCH-02A	MCH-03A	MCH-04A	MCH-05A	MCH-06A	MCH-07A	MCH-08A	MCH-09A	MCH-10A	MCH-11A
Equipment Requiring Testing or Verification	# of units	Outdoor Ventilation	Single Zone Unitary	Air Distribution Ducts	Economizer Controls	Demand Control Ventilation (DCV)	Supply Fan VAV	Valve Leakage Test	Supply Water Temp. Reset	Hydronic System Variable Flow Control	Automatic Demand Shed Control
<b>A/C 5 ton unit</b>	<b>2</b>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Economizer</b>	<b>1</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



# Lighting

## 2008 – §146

- Allowed lighting power density (watts/ft<sup>2</sup>)
  - Complete building method
  - Area category method
  - Tailored method
  - TABLES 146-E through G
- Power adjustment factor (PAF)
  - Reduces proposed watts/ft<sup>2</sup> with lighting controls
  - TABLE 146-C

## 2013 – §140.6

- Allowed watts/ft<sup>2</sup>
  - [TABLES 140.6-B through D](#)
  - No major changes for complete building and area category method values
  - Tailored method values changed and determined by general illumination level (Lux)
- PAFs updated
  - [TABLE 140.6-A](#)

**TABLE 140.6-B COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES**

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

**TABLE 140.6-C AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES (WATTS/FT<sup>2</sup>)**

PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER (W/ft <sup>2</sup> )	PRIMARY FUNCTION AREA	ALLOWED LIGHTING POWER (W/ft <sup>2</sup> )	
Auditorium Area		1.5 <sup>3</sup>	Library Area	Reading areas	1.2 <sup>3</sup>
Auto Repair Area		0.9 <sup>2</sup>		Stack areas	1.5 <sup>3</sup>
Beauty Salon Area		1.7	Lobby Area	Hotel lobby	1.1 <sup>3</sup>
Civic Meeting Place Area		1.3 <sup>3</sup>		Main entry lobby	1.5 <sup>3</sup>
Classroom, Lecture, Training, Vocational Areas		1.2 <sup>5</sup>	Locker/Dressing Room		0.8
Commercial and Industrial Storage Areas (conditioned and unconditioned)		0.6	Lounge Area		1.1 <sup>3</sup>
Commercial and Industrial Storage Areas (refrigerated)		0.7	Malls and Atria		1.2 <sup>3</sup>
Convention, Conference, Multipurpose and Meeting Center Areas		1.4 <sup>3</sup>	Medical and Clinical Care Area		1.2
Corridor, Restroom, Stair, and Support Areas		0.6	Office Area	> 250 square feet	0.75
Dining Area				≤ 250 square feet	1.0
Electrical, Mechanical, Telephone Rooms		0.7 <sup>2</sup>	Parking Garage Area	Parking Area	0.14
Exercise Center, Gymnasium Areas				Dedicated Ramps	0.3
Exhibit, Museum Areas		2.0	Daylight Adaptation Zones <sup>9</sup>		0.6
Financial Transaction Area		1.2 <sup>3</sup>	Religious Worship Area		1.5 <sup>3</sup>
General Commercial and Industrial Work Areas	Low bay	0.9 <sup>2</sup>	Retail Merchandise Sales, Wholesale Showroom Areas		1.2 <sup>6 and 7</sup>
	High bay	1.0 <sup>2</sup>			
	Precision	1.2 <sup>4</sup>	Theater Area	Motion picture	0.9 <sup>3</sup>
Grocery Sales Area		1.2 <sup>6 and 7</sup>		Performance	1.4 <sup>3</sup>
Hotel Function Area		1.5 <sup>3</sup>	Transportation Function Area		1.2
Kitchen, Food Preparation Areas		1.6	Videoconferencing Studio		1.2 <sup>8</sup>
Laboratory Area, Scientific		1.4 <sup>1</sup>	Waiting Area		1.1 <sup>3</sup>
Laundry Area		0.9	All other areas		0.6

Footnotes for this table are listed below.

**FOOTNOTES FOR TABLE 140.6-C:**

See Section 140.6(c)2 for an explanation of additional lighting power available for specialized task work, ornamental, precision, accent, display, decorative, and white boards and chalk boards, in accordance with the footnotes in this table. The smallest of the added lighting power listed in each footnote below, or the actual design wattage, may be added to the allowed lighting power only when using the Area Category Method of compliance.

Footnote number	Type of lighting system allowed	Maximum allowed added lighting power. (W/ft <sup>2</sup> of task area unless otherwise noted)
1	Specialized task work	0.2 W/ft <sup>2</sup>
2	Specialized task work	0.5 W/ft <sup>2</sup>
3	Ornamental lighting as defined in Section 100.1 and in accordance with Section 140.6.(c)2.	0.5 W/ft <sup>2</sup>
4	Precision commercial and industrial work	1.0 W/ft <sup>2</sup>
5	Per linear foot of white board or chalk board.	5.5 W per linear foot
6	Accent, display and feature lighting - luminaires shall be adjustable or directional	0.3 W/ft <sup>2</sup>
7	Decorative lighting - primary function shall be decorative and shall be in addition to general illumination.	0.2 W/ft <sup>2</sup>
8	Additional Videoconferencing Studio lighting complying with all of the requirements in Section 140.6(c)2Gvii.	1.5 W/ft <sup>2</sup>
9	Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage	

**TABLE 140.6-D TAILORED METHOD LIGHTING POWER ALLOWANCES**

1	2	3	4	5
Primary Function Area	General Illumination Level (Lux)	Wall Display Power (W/ft)	Allowed Combined Floor Display Power and Task Lighting Power (W/ft <sup>2</sup> )	Allowed Ornamental/ Special Effect Lighting
Auditorium Area	300	2.25	0.3	0.5
Civic Meeting Place	300	3.15	0.2	0.5
Convention, Conference, Multipurpose, and Meeting Center Areas	300	2.50	0.4	0.5
Dining Areas	200	1.50	0.6	0.5
Exhibit, Museum Areas	150	15.0	1.2	0.5
Financial Transaction Area	300	3.15	0.2	0.5
Grocery Store Area	500	8.00	0.9	0.5
Hotel Function Area	400	2.25	0.2	0.5
Lobby Area:				
Hotel lobby	200	3.15	0.2	0.5
Main entry lobby	200	0	0.2	0
Lounge Area	200	7.00	0	0.5
Malls and Atria	300	3.50	0.5	0.5
Religious Worship Area	300	1.50	0.5	0.5
Retail Merchandise Sales, and Showroom Areas	400	14.00	1.0	0.5
Theater Area:				
Motion picture	200	3.00	0	0.5
Performance	200	6.00	0	0.5
Transportation Function Area	300	3.15	0.3	0.5
Waiting Area	300	3.15	0.2	0.5

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

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



# §140.6 and the Plans Examiner

STATE OF CALIFORNIA  
INDOOR LIGHTING  
COMPLIANCE FORM (LTI-01)

CERTIFICATE OF COMPLIANCE - USER INSTRUCTIONS (Page 4 of 5)

Project Name: 2013 CALBO Training Sample Date Project: 01/09/14

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

A separate Lighting Schedule must be filled out for conditioned and unconditioned spaces; installed Lighting Power listed on this Lighting Schedule is only for:  
 CONDITIONED SPACE  UNCONDITIONED SPACE

**C. INDOOR LIGHTING SCHEDULE and FIELD INSPECTION ENERGY CHECKLIST**

Luminaire Schedule		Installed Watts				Location		Field Inspector <sup>1</sup>	
A	B	C	D	E	F	G	H	I	J
Number of Lamps per Fixture	Complete Luminaire Description (i.e., 3 lamp fluorescent troffer, F3278, one dimmable electronic ballast)	Watts per Lamp	How wattage was determined	Number of Lamps per Fixture	Watts per Fixture	Primary Function area in which these luminaires are installed	Pass	Fail	
	13W Compact Fluorescent Twin 2 pin 4W per ft Track light	34.0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	20	680	Atrium	<input type="checkbox"/>	<input type="checkbox"/>
	4 ft Fluorescent T8 Rapid Start Elec.	48.0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	20	960	Sales Floor	<input type="checkbox"/>	<input type="checkbox"/>
		62.0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	20	1,240	Office Space	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
INSTALLED WATTS PAGE TOTAL:							Enter sum total of all pages into NRCC-LTI-01-E, Page 2		

CA Building Energy Efficiency Standards - 2013 Nonresidential Compliance June 2013

- Still verify proposed watts/ft<sup>2</sup> on NRCC-LTI-01 form
  - Values should match lighting schedule on electrical plans
- Verify PAF control credits on NRCC-LTI-02
- NRCC-LTI-03 req. when complete building or area category method used
- NRCC-LTI-04 req. when tailored method used

\* Forms must be registered starting 1/1/15

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

Total installed portable luminaire watts that are greater than 0.3 watts per square foot per office:	Enter sum total of all pages into NRCC-LTI-01-E; Page 2
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A separate Lighting Schedule Must Be Filled Out for Conditioned and Unconditioned Spaces. Installed Lighting Power listed on this Lighting Schedule is only for:

**CONDITIONED SPACE**       **UNCONDITIONED SPACE**

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



## §140.6 and the Field Inspector

- **At Rough Frame verify**
  - Installed watts/ft<sup>2</sup>
  - Shall not exceed values on [NRCC-LTI-01](#) form
- **If PAF controls credits were used**
  - Verify controls are installed
  - Simplify with [NRCI-LTI-05](#)





CERTIFICATE OF INSTALLATION		NRCI-LTI-05-H
Power Adjustment Factors		(Page 1 of 5)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

GENERAL INFORMATION				
DATE OF BUILDING PERMIT	PERMIT #			
BUILDING TYPE	<input type="checkbox"/> Nonresidential	<input type="checkbox"/> High-Rise Res (Common Area)	<input type="checkbox"/> Hotel/Motel (Common Area)	
PHASE OF CONSTRUCTION	<input type="checkbox"/> New Construction	<input type="checkbox"/> Addition	<input type="checkbox"/> Alteration	<input type="checkbox"/> Unconditioned

SCOPE OF RESPONSIBILITY	
Enter the date of approval by enforcement agency of the Certificate of Compliance that provides the specifications for the energy efficiency measures for the scope of responsibility for this Installation Certificate:	Date:

**Power Adjustment Factor (PAF)**

§130.4(b) - Before a Power Adjustment Factor will be allowed for compliance with Section 140.6 of Part 6 of Title 24, the person who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the construction or installation of features, materials, components, or manufactured devices shall sign and submit this Installation Certificate.

§140.6(a) 2 - Reduction of wattage through controls. In calculating actual indoor Lighting Power Density, the installed watts of a luminaire providing general lighting in an area listed in TABLE 140.6-A may be reduced by the product of (i) the number of watts controlled as described in TABLE 140.6-A, times (ii) the applicable Power Adjustment Factor (PAF), if all of the conditions [in this Certificate of Installation are met]:

If any of the requirements in this Installation Certificate fail, the installation shall not be eligible for using the PAF.

**Check all that apply:****PART 1 Certificate Of Compliance Correctly Filled Out**

- In addition to this Certificate of Installation, the PAF has been correctly document on page 2 of NRCC-LTI-02—E of the Certificate of Compliance submitted to the building department.

**PART 2 Type of PAF** **A. This installation qualifies for the following PAFs:**

1. This installation qualifies for the PAF for a Partial-ON Occupant Sensing Control in TABLE 140.6-A because it meets all of the following requirements:
- a. The Partial-ON Occupant Sensing Control is use in only the following space types:
    - i, An area  $\leq$  250 square feet enclosed by floor-to-ceiling partitions
    - ii. A classroom of any size
    - iii. A conference room of any size
    - iv. A waiting room of any size
  - b. The PAF used is 0.20
  - c. The control automatically deactivates all of the lighting power in the area within 30 minutes after the room has been vacated; and
  - d. The first stage automatically activates between 30-70 percent of the lighting power in the area
  - e. The lighting control is a:
    - i. Switching system, or



CERTIFICATE OF INSTALLATION		NRCI-LTI-05-H
Power Adjustment Factors		(Page 2 of 5)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

- ii. Dimming system; and
  - f. The second stage manually activates the alternate set of lights; and
  - g. This manual-ON function is not capable of conversion from manual-ON to automatic-ON functionality via manual switches or dip switches; and
  - h. Switches are located in accordance with Section 130.1(a)
  - i. Occupants can manually do all of the following regardless of the sensor status:
    - Activate the alternate set of lights; and
    - Activate 100 percent of the lighting power; and
    - Deactivate all of the lights.
2. This installation qualifies for the PAF for an occupant sensing control controlling the general lighting in large open plan office areas above workstations, in accordance with TABLE 140.6-A, because the following requirements have been met:
- a. The occupant sensing controls are in large open plan offices that are greater than 250 square feet and:
    - i. One sensor is controlling an area that is no larger than 125 square feet, and the PAF used in 0.40
    - ii. One sensor is controlling an area that is from 126 to 250 square feet, and the PAF used in 0.30
    - iii. One sensor is controlling an area that is from 251 to 500 square feet, and the PAF used in 0.20
  - b. This PAF is only being applied only to office areas which contain workstations; and
  - c. Controlled luminaires are only those which provide general lighting directly above the controlled area, or furniture mounted luminaires that comply with Section 140.6(a)2 and provide general lighting directly above the controlled area; and
  - d. Qualifying luminaires have been controlled by occupant sensing controls that meet all of the following requirements, as applicable:
    - i. Infra-red sensors have been equipped by the manufacturer, or fitted in the field by the installer, with lenses or shrouds to prevent them from being triggered by movement outside of the controlled area.
    - ii. Ultrasonic sensors have been tuned to reduce their sensitivity to prevent them from being triggered by movements outside of the controlled area.
    - iii. All other sensors have been installed and adjusted as necessary to prevent them from being triggered by movements outside of the controlled area.
3. This installation qualifies for the PAF for a Manual Dimming System or a Multiscene Programmable Dimming System in TABLE 140.6-A because:
- a. The lighting is controlled with a control that can be manually operated by the user; and
  - b. The space is only of the following type:
    - i. Hotel/motel
    - ii. Restaurant
    - iii. Auditorium
    - iv. Theater
  - c. The type of control and PAF used is one of the following:
    - i. A Dimming System with manual dimming and the PAF used is 0.10



CERTIFICATE OF INSTALLATION		NRCI-LTI-05-H
Power Adjustment Factors		(Page 3 of 5)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

- ii. A Multiscene Programmable control and the PAF used is 0.20
4. This installation qualifies for the PAF for a Demand Responsive Control in TABLE 140.6-A, because the installation meets all of the following requirements:
- i. The building is 10,000 square feet or smaller; and
  - ii. The PAF used is 0.05. Note that luminaires that qualify for other PAFs may also qualify for this demand responsive control PAF.
  - iii. The controlled lighting is capable of being automatically reduced in response to a demand response signal; and
  - iv. Lighting has been reduced in a manner consistent with uniform level of illumination requirements in TABLE 130.1-A; and
  - v. Spaces that are non-habitable have not been used to comply with this requirement, and
  - v. Spaces with a lighting power density of less than 0.5 watts per square foot have not been counted toward the building's total lighting power.
5. This installation qualifies for the PAF for Combined Manual Dimming plus Partial-ON Occupant Sensing Control in TABLE 140.6-A because the installation meets all of the following requirements:
- a. The Combined Control is use in only the following space types:
    - i, An area  $\leq$  250 square feet enclosed by floor-to-ceiling partitions
    - ii. A classroom of any size
    - iii. A conference room of any size
    - iv. A waiting room of any size
  - b. The lighting is controlled with a control that can be manually operated by the user; and
  - c. The dimming component is one of the following:
    - i. A Dimming System with manual dimming; or
    - ii. A Multiscene Programmable control
  - d. The Partial-ON Occupant Sensing component automatically deactivates all of the lighting power in the area within 30 minutes after the room has been vacated; and
    - i. The first stage automatically activates between 30-70 percent of the lighting power in the area
    - ii. The lighting control is a:
      - Switching system, or
      - Dimming system; and
    - iii. The second stage manually activates the alternate set of lights; and
    - iv. This manual-ON function is not capable of conversion from manual-ON to automatic-ON functionality via manual switches or dip switches; and
    - v. Switches are located in accordance with Section 130.1(a)
    - vi. Occupants can manually do all of the following regardless of the sensor status:
      - Activate the alternate set of lights; and
      - Activate 100 percent of the lighting power; and
      - Deactivate all of the lights.
  - e. The PAF used is 0.25

### **PART 3 PAF Minimum Requirements**

***Check all that apply:***



CERTIFICATE OF INSTALLATION		NRCI-LTI-05-H
Power Adjustment Factors		(Page 4 of 5)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

- A. The lighting control used to earn the PAF is designed and installed in addition to all manual, and automatic lighting controls otherwise required in 130.1(a) through (e)
- EXCEPTION. The lighting control used to earn a PAF has been designed and installed for the sole purpose of compliance with Section 130.1(b)3, and this lighting control is designed and installed in addition to all other manual, and automatic lighting controls otherwise required in Section 130.1.
- B. Installed wattage has been determined in accordance with Section 130.0(c)
- C. Space types that qualify for the PAF comply with the definition for that space type in Section 100.1(b)
- D. Self contained lighting controls used to earn the PAF comply with Section 110.9 and are certified in accordance with the Appliance Efficiency Regulations, as verified on the Title 20 database of certified lighting controls
- E. A lighting control system is used to earn the PAF, which complies with Section 110.9.
- When using a lighting control system to earn a PAF, also submit the Installation Certificate for Energy Management Control System and Lighting Control System
- F. The controls are permanently installed nonresidential-rated lighting controls. (Portable lighting, portable lighting controls, and residential rated lighting controls shall not qualify for PAFs.)
- G. The controlled lighting used to earn this PAF is a permanently installed general lighting system.
- Furniture mounted luminaires qualify as general lighting system for the purpose of earning this PAF because the general lighting is in an office, and the furniture mounted luminaires comply with all of the following conditions:
- i. The furniture mounted luminaires have been permanently installed no later than the time of building permit inspection; and
- ii. The furniture mounted luminaires have been permanently hardwired; and
- iii. The furniture mounted lighting system has been designed to provide indirect general lighting; and
- iv. Before multiplying the installed watts of the furniture mounted luminaire by the applicable PAF, 0.3 watts per square foot of the area illuminated by the furniture mounted luminaires has been subtracted from installed watts of the furniture mounted luminaires; and
- H. At least 50 percent of the light output of the controlled luminaire is within the applicable area listed in TABLE 140.6-A. Luminaires on lighting tracks are within the applicable area in order to qualify for a PAF.
- I. Only one PAF from TABLE 140.6-A has been used for each qualifying luminaire. PAFs have not been added together unless specifically allowed in TABLE 140.6-A.
- L. Only lighting wattage directly controlled in accordance with Section 140.6(a)2 has been used to reduce the calculated actual indoor Lighting Power Densities as allowed by Section 140.6(a)2.
- Only a portion of the wattage in a luminaire is controlled in accordance Section 140.6(a)2, and only that portion of controlled wattage has been reduced in calculating actual indoor Lighting Power Density.



## §140.6 and the Field Inspector *cont.*

- **All req. NRCCI-LTI forms must be verified**
  - Refer to [NRCC-LTI-01](#) (use as checklist)
  - Completed by installing contractor
- **All req. NRCA-LTI forms must be verified**
  - Refer to NRCC-LTI-01 (use as checklist)
  - Must be performed by CLCATT when required
- **All forms must be registered beginning 1/1/15**



## Covered Processes

- **New prescriptive requirements in §140.9**
- **Computer room reqs. in §140.9(a)**
  - Economizers
  - Reheat, humidification, fan power consumption and controls, containment
- **Commercial kitchen reqs. in §140.9(b)**
  - Applicable to Type I and Type II kitchen hoods with total exhaust airflow rate > 5,000 cfm
  - Maximum exhaust rates in TABLE 140.9-A
  - Acceptance testing req. for exhaust rate
- **Laboratory exhaust reqs. in §140.9(c)**
  - Applicable when min. circulation rate is  $\leq 10$  ACH

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## SECTION 140.9 – PRESCRIPTIVE REQUIREMENTS FOR COVERED PROCESSES

(a) **Prescriptive Requirements for Computer Rooms.** A computer room complies with this section by being designed with and having constructed and installed a cooling system that meets the requirements of Subsections 1 through 6.

**1. Economizers.** Each individual cooling system primarily serving computer room(s) shall include either:

- A. An integrated air economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with a method approved by the Commission, at outside air temperatures of 55°F dry-bulb/50°F wet-bulb and below; or
- B. An integrated water economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with a method approved by the Commission, at outside air temperatures of 40°F dry-bulb/35°F wet-bulb and below.

**EXCEPTION 1 to Section 140.9(a)1:** Individual computer rooms under 5 tons in a building that does not have any economizers.

**EXCEPTION 2 to Section 140.9(a)1:** New cooling systems serving an existing computer room in an existing building up to a total of 50 tons of new cooling equipment per building.

**EXCEPTION 3 to Section 140.9(a)1:** New cooling systems serving a new computer room in an existing building up to a total of 20 tons of new cooling equipment per building.

**EXCEPTION 4 to Section 140.9(a)1:** A computer room may be served by a fan system without an economizer if it is also served by a fan system with an economizer that also serves noncomputer room(s) provided that all of the following are met:

- i. The economizer system is sized to meet the design cooling load of the computer room(s) when the noncomputer room(s) are at 50 percent of their design load; and
- ii. The economizer system has the ability to serve only the computer room(s), e.g. shut off flow to noncomputer rooms when unoccupied; and
- iii. The noneconomizer system does not operate when the outside air drybulb temperatures is below 60°F and, the cooling load of the non-computer room(s) served by the economizer system is less than 50 percent of design load.

**2. Reheat.** Each computer room zone shall have controls that prevent reheating, recooling and simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by cooling equipment or by economizer systems.

**3. Humidification.** Nonadiabatic humidification (e.g. steam, infrared) is prohibited. Only adiabatic humidification (e.g. direct evaporative, ultrasonic) is permitted.

**4. Power Consumption of Fans.** The total fan power at design conditions of each fan system shall not exceed 27 W/kBtu-h of net sensible cooling capacity.

**5. Fan Control.** Each unitary air conditioner with mechanical cooling capacity exceeding 60,000 Btu/hr and each chilled water fan system shall be designed to vary the airflow rate as a function of actual load and shall have controls and/or devices (such as two-speed or variable speed control) that will result in fan motor demand of no more than 50 percent of design wattage at 66 percent of design fan speed.

**6. Containment.** Computer rooms with air-cooled computers in racks and with a design load exceeding 175 kW/room shall include air barriers such that there is no significant air path for computer discharge air to recirculate back to computer inlets without passing through a cooling system.

**EXCEPTION 1 to Section 140.9(a)6:** Expansions of existing computer rooms.

**EXCEPTION 2 to Section 140.9(a)6:** Computer racks with a design load less than 1 kW/rack.

**EXCEPTION 3 to Section 140.9(a)6:** Equivalent energy performance based on computational fluid dynamics or other analysis.

**(b) Prescriptive Requirements for Commercial Kitchens.**

**1. Kitchen exhaust systems.**

- A. Replacement air introduced directly into the hood cavity of kitchen exhaust hoods shall not exceed 10 percent of the hood exhaust airflow rate.
- B. For kitchen/dining facilities having total Type I and Type II kitchen hood exhaust airflow rates greater than 5,000 cfm, each Type I hood shall have an exhaust rate that complies with TABLE 140.9-A. If a single hood or hood section is installed over appliances with different duty ratings, then the maximum allowable flow rate for the hood or hood section shall not exceed the TABLE 140.9-A values for the highest appliance duty rating under the hood or hood section. Refer to ASHRAE Standard 154-2011 for definitions of hood type, appliance duty and next exhaust flow rate.

**EXCEPTION 1 to Section 140.9(b)1B:** 75 percent of the total Type I and Type II exhaust replacement air is transfer air that would otherwise be exhausted.

**EXCEPTION 2 to Section 140.9(b)1B:** Existing hoods not being replaced as part of an addition or alteration.

*TABLE 140.9-A MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH*

Type of Hood	Light Duty Equipment	Medium Duty Equipment	Heavy Duty Equipment	Extra Heavy Duty Equipment
Wall-mounted Canopy	140	210	280	385
Single Island	280	350	420	490
Double Island	175	210	280	385
Eyebrow	175	175	Not Allowed	Not Allowed
Backshelf / Passover	210	210	280	Not Allowed

**2. Kitchen ventilation.**

- A. Mechanically cooled or heated makeup air delivered to any space with a kitchen hood shall not exceed the greater of:
  - i. The supply flow required to meet the space heating and cooling load; or
  - ii. The hood exhaust flow minus the available transfer air from adjacent spaces. Available transfer air is that portion of outdoor ventilation air serving adjacent spaces not required to satisfy other exhaust needs, such as restrooms, not required to maintain pressurization of adjacent spaces, and that would otherwise be relieved from the building.

**EXCEPTION to Section 140.9(b)2A:** Existing kitchen makeup air units not being replaced as part of an addition or alteration.

**B. A kitchen/dining facility having a total Type I and Type II kitchen hood exhaust airflow rate greater than 5,000 cfm shall have one of the following:**

- i. At least 50 percent of all replacement air is transfer air that would otherwise be exhausted; or
- ii. Demand ventilation system(s) on at least 75 percent of the exhaust air. Such systems shall:
  - a. Include controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle; and
  - b. Include failsafe controls that result in full flow upon cooking sensor failure; and

- c. Include an adjustable timed override to allow occupants the ability to temporarily override the system to full flow; and
- d. Be capable of reducing exhaust and replacement air system airflow rates to the larger of:
  - (i) 50 percent of the total design exhaust and replacement air system airflow rates; or
  - (ii) The ventilation rate required per Section 120.1.
- iii. Listed energy recovery devices with a sensible heat recovery effectiveness of not less than 40 percent on at least 50 percent of the total exhaust airflow; and
- iv. A minimum of 75 percent of makeup air volume that is:
  - a. Unheated or heated to no more than 60°F; and
  - b. Uncooled or cooled without the use of mechanical cooling.

**EXCEPTION to Section 140.9(b)2B:** Existing hoods not being replaced as part of an addition or alteration.

**3. Kitchen Exhaust System Acceptance.** Before an occupancy permit is granted for a commercial kitchen subject to Section 140.9(b), the following equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.11.

**(c) Prescriptive Requirements for Laboratory exhaust systems.** For buildings with laboratory exhaust systems where the minimum circulation rate to comply with code or accreditation standards is 10 ACH or less, the design exhaust airflow shall be capable of reducing zone exhaust and makeup airflow rates to the regulated minimum circulation rate, or the minimum required to maintain pressurization requirements, whichever is larger. Variable exhaust and makeup airflow shall be coordinated to achieve the required space pressurization at varied levels of demand and fan system capacity.

**EXCEPTION 1 to Section 140.9(c):** Laboratory exhaust systems serving zones where constant volume is required by the Authority Having Jurisdiction, facility Environmental Health & Safety department or other applicable code.

**EXCEPTION 2 to Section 140.9(c):** New zones on an existing constant volume exhaust system.



# §140.9 and the Plans Examiner

**COMMERCIAL KITCHEN REQUIREMENTS**  
CERTIFICATE OF COMPLIANCE  
Project Name: 2015 CALBC Training Sample

**COMPUTER ROOM REQUIREMENTS**  
CERTIFICATE OF COMPLIANCE  
Project Name: 2015 CALBC Training Sample

Equipment Tags and System Description <sup>2</sup>	7-24 Sections	Reference to the requirements in the Contract Documents <sup>3</sup>
Economizers	140.9(a)1	Air economizer
Reheat	140.9(a)2	M 2 (note block)
Humidification	140.9(a)3	Adiabatic
Fan Power	140.9(a)4	20 WkEtoH
Fan Control	140.9(a)5	N/A
Containment	140.9(a)6	N/A

- Verify applicable Certificate of Compliance on plans
  - NRCC-PRC-03 (Kitchens)
  - NRCC-PRC-04 (Computer rooms)
  - NRCC-PRC-09 (Laboratory)
- Verify specifications match the plans (mechanical schedules, note blocks, etc.)



CERTIFICATE OF COMPLIANCE		NRCC-PRC-03-E
Commercial Kitchen Requirements		(Page 1 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>	

KITCHEN ROOM NUMBER <sup>1</sup> <b>Kitchen 1</b>	
TOTAL INSTALLED TYPE I and II KITCHEN HOOD EXHAUST (CFM) <sup>2</sup> : <b>5,500 cfm</b>	VENTILATION COMPLIANCE METHOD:
TOTAL BYPASS HOOD MUA (CFM) <sup>3</sup> : <b>1,000 cfm</b>	Small Kitchens ( $\leq 5,000$ CFM Type I and II Hood Exhaust)
TOTAL TRANSFER AIR AIRFLOW (CFM) <sup>4</sup> : <b>500 cfm</b>	140.9(b)2 A i or 140.9(b)2 A ii
TOTAL MECHANICALLY HEATED OR COOLED MAKE UP AIR (CFM) <sup>5</sup> : <b>250 cfm</b>	Large Kitchens ( $> 5,000$ CFM Type I and II Hood Exhaust)
TOTAL AIR NEEDED FOR HEATING OR COOLING (CFM) <sup>6</sup> : <b>600 cfm</b>	140.9(b)2Bi or 140.9(b)2Bii(a) or o 140.9(b)2Bii(b) or
TOTAL EXHAUST AIR WITH DEMAND VENTILATION SYSTEMS <sup>7</sup> : N/A	140.9(b)2Bii(c) or 140.9(b)2Bii(d)

Equipment Tags and System Description <sup>8</sup>		Hoods 1 & 2		
<b>PRESCRIPTIVE MEASURES</b>	<b>T-24 Sections</b>	<b>Reference to the Requirements in the Contract Documents<sup>9</sup></b>		
Bypass Hood Exhaust and MUA	140.9(b)1A	<b>M.3 (schedule)</b>		
Type I/II Hood Exhaust	140.9(b)1B, Table 140.9-A	<b>M.3 (schedule)</b>		
Mechanically heated or cooled make up air	140.9(b)2A	<b>250 cfm</b>		
Demand Ventilation Systems	140.9(b)2Bii	<b>N/A</b>		
Energy Recovery Systems	140.9(b)2Biii	<b>N/A</b>		
Tempered/Non Mechanical Cooling Air Systems	140.9(b)2Biv	<b>N/A</b>		

<b>Notes:</b>
1. Fill in one form for each kitchen in the project.
2. Enter the total installed type I and II kitchen hood exhaust airflow in cubic feet per minute (cfm).
3. Enter the make-up air to bypass hoods (cfm).
4. Enter the total transfer air (cfm).
5. Enter the total mechanically cooled or heated make up air (cfm).
6. Enter the maximum air needed for heating or cooling loads (cfm).
7 Enter the design airflow (cfm) of exhaust with demand ventilation system controls
8. Provide equipment tags (e.g., AHU 1 & 2 or Hoods 1 to 5) for all equipment that is covered by these requirements. Equipment that is similar in requirements and compliance can be grouped in a single column.
9. Provide references to plans (i.e. Drawing Sheet Numbers) and/or specifications (including Section name/number and relevant paragraphs) where each requirement is specified. Enter "N/A" if the requirement is not applicable to this system. Explicitly list any exceptions used to avoid a requirement.



CERTIFICATE OF COMPLIANCE		NRCC-PRC-04-E
Computer Room Requirements		(Page 1 of 1)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>	

TOTAL INSTALLED COOLING CAPACITY (TONS) <sup>1</sup> :				
Equipment Tags and System Description <sup>2</sup>		AHU 1 and 2		
<b>PRESCRIPTIVE MEASURES</b>	<b>T-24 Sections</b>	<b>Reference to the Requirements in the Contract Documents<sup>3</sup></b>		
Economizers	140.9(a)1	<b>Air economizer</b>		
Reheat	140.9(a)2	<b>M.2 (note block)</b>		
Humidification	140.9(a)3	<b>Adiabatic</b>		
Fan Power	140.9(a)4	<b>20 W/kBtu-H</b>		
Fan Control	140.9(a)5	<b>N/A</b>		
Containment	140.9(a)r	<b>N/A</b>		

**Notes:**

1. Enter the total installed cooling capacity for all computer rooms under this permit
2. Provide equipment tags (e.g. CRAC-1 to 10, AHU 1 to 5 and CH 1 to 3) for all cooling systems that are covered by these requirements. Groups of equipment that are similar can be combined into one column.
3. Provide references to plans (i.e. Drawing Sheet Numbers) and/or specifications (including Section name/number and relevant paragraphs) where each requirement is specified. Enter "N/A" if the requirement is not applicable to this system. Explicitly list any exceptions used to avoid a requirement.

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Company:	Signature Date:
Address:	CEA/ HERS Certification Identification (if applicable):
City/State/Zip:	Phone:
RESPONSIBLE PERSON'S DECLARATION STATEMENT	
I certify the following under penalty of perjury, under the laws of the State of California:	
<ol style="list-style-type: none"> <li>1. The information provided on this Certificate of Compliance is true and correct.</li> <li>2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).</li> <li>3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.</li> <li>4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.</li> <li>5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.</li> </ol>	
Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip:	Phone:



<b>CERTIFICATE OF COMPLIANCE</b>		NRCC-PRC-09-E
Laboratory Exhaust		(Page 1 of 1)
Project Name: <b>2013 CALBO Training Sample</b>	Date Prepared: <b>01/01/14</b>	

<b>System air flow as designed :</b> <u>    10    </u> ACH				
<b>Equipment Tags and System Description<sup>2</sup></b>		<b>EF 1</b>		
<b>PRESCRIPTIVE MEASURES</b>	<b>T-24 Sections</b>	<b><del>Reference to the Requirements in the Contract Documents<sup>3</sup></del></b>		
Exhaust system with VAV hood	140.9(c)	<b>M.2 (schedule)</b>		
Exhaust system without VAV hood – Exc. 1e	140.9(c) Exception 1	<b>N/A</b>		
Exhaust system without VAV hood – Exc. 1e	140.9(c) Exception 2	<b>N/A</b>		
<b>Notes:</b>				
1. Enter the designed system air flow rate in Air Changes per Hour (ACH) for all Laboratory systems under this permit.				
2. Provide equipment tags (e.g. EF-1 to x and AHU 1 to y) for all systems that are covered by these requirements. This includes systems that are VAV flow Hoods as well as system that are exempted as per sections 1 or 2 under section 140.9 ( c ).				
3. Provide references to plans (i.e. Drawing Sheet Numbers) and/or specifications (including Section name/number and relevant paragraphs) where each requirement is specified. Enter "N/A" if the requirement is not applicable to this system. Explicitly list which exception is used (if used).				

<b>DOCUMENTATION AUTHOR'S DECLARATION STATEMENT</b>	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name:	Documentation Author Signature:
Company:	Signature Date:
Address:	CEA/ HERS Certification Identification (if applicable):
City/State/Zip:	Phone:

<b>RESPONSIBLE PERSON'S DECLARATION STATEMENT</b>	
I certify the following under penalty of perjury, under the laws of the State of California:	
1. The information provided on this Certificate of Compliance is true and correct.	
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).	
3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.	
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.	
5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.	
Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip:	Phone:



## §140.9 and the Field Inspector

- **Verify at Final**
  - Installed cooling system for computer rooms meets economizer and design reqs.
  - Installed exhaust hoods in commercial kitchens meet exhaust reqs. when applicable
    - [NRCA-PRC-02](#) form req.
  - Installed exhaust system for laboratories meets exhaust reqs. when applicable





CERTIFICATE OF ACCEPTANCE		NRCA-PRC-02-F
Commercial Kitchen Exhaust System Acceptance		(Page 1 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

<i>Note: Submit one Certificate of Acceptance for each system that must demonstrate compliance.</i>	Enforcement Agency Use: Checked by/Date
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<b>Intent:</b> Verify that airside economizers function properly
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<p><b>Construction Inspection</b></p> <p>1. Supporting documentation needed to perform test includes:</p> <ol style="list-style-type: none"> <li>2013 Building Energy Efficiency Standards Nonresidential Compliance Manual (<i>NA7.5.4 Air Economizer Controls Acceptance At-A-Glance</i>).</li> <li>2013 Building Energy Efficiency Standards.</li> </ol> <p>2. Instrumentation to perform test includes:</p> <ol style="list-style-type: none"> <li>Space differential pressure sensor Calibration Date: <u>1/1/14</u> (must be within last year)</li> <li>Recording Analog Manometer with Pitot Tube and VelGrid Calibration Date: <u>1/1/14</u> (must be within last year)</li> </ol> <p>3. Installation: (all of the following boxes should be checked)</p> <p><input checked="" type="checkbox"/> Exhaust and make-up air systems and installed and fully functional.</p> <p><input checked="" type="checkbox"/> Demand Ventilation Control systems (if installed) are fully functional and have been set up and calibrated by the installing contactor</p> <p><input checked="" type="checkbox"/> For Kitchens with &gt;5,000 cfm of Type I and Type II kitchen hood exhaust, All Type I hoods meet the requirements of Table 140.9-A</p>
---

A. Functional Testing	Results
The following acceptance test applies to systems with and without demand control ventilation exhaust systems. These tests shall be conducted at full load conditions for each hood.	
<b>Step 1: Setup:</b>	
a. Operate all sources of outdoor air providing replacement air for the hoods	(Y) N
b. Operate all sources of recirculated air providing conditioning for the space in which the hoods are located	(Y) N
c. Operate all appliances under the hoods at operating temperatures	(Y) N
<b>Step 2: Verify the following:</b>	
a. Verify that the thermal plume and smoke is completely captured and contained within each hood at full load conditions by observing smoke or steam produced by actual cooking operation and/or by visually seeding the thermal plume using devices such as smoke candles or smoke puffers. Smoke bombs shall not be used (note: smoke bombs typically create a large volume of effluent from a point source and do not necessarily confirm whether the cooking effluent is being captured). For some appliances (e.g., broilers, griddles, fryers), actual cooking at the normal production rate is a reliable method of generating smoke). Other appliances that typically generate hot moist air without smoke (e.g., ovens, steamers) need seeding of the thermal plume with artificial smoke to verify capture and containment.	(Y) N
b. Verify that space pressurization is appropriate (e.g. kitchen is slightly negative relative to adjacent spaces and all doors open/close properly).	(Y) N
c. Verify that each Type 1 hood has an exhaust rate that is at or below the maximum allowed.	(Y) N / NA
<b>Step 3: Make adjustments as necessary until full capture and containment and adequate space pressurization are achieved and maximum allowable exhaust rates are not exceeded. Adjustments may include: adjust exhaust hood airflow rates; Add hood side panels; Add rear seal (back plate); Increase hood overhang by pushing hood back; and Relocate supply outlets to improve the</b>	

# COMMERCIAL KITCHEN EXHAUST SYSTEM ACCEPTANCE



CERTIFICATE OF ACCEPTANCE		NRCA-PRC-02-F
Commercial Kitchen Exhaust System Acceptance		(Page 2 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

capture and containment performance	
<b>Step 4:</b> Measure and record the final airflow for each Type I hood.	<input checked="" type="radio"/> Y / N / NA

The following additional acceptance test shall be performed on all exhaust hoods with demand control ventilation exhaust systems.

**Step 5:** Turn off all kitchen hoods, makeup air and transfer systems

**Step 6:** Turn on one of the appliances on the line and bring to operating temperature. Confirm that::

a. DCV system automatically switches from off to the minimum flow setpoint.	<input checked="" type="radio"/> Y / N
b. The minimum flow setpoint does not exceed the larger of: 50% of the design flow, or; the ventilation rate required per Section 120.1.	<input checked="" type="radio"/> Y / N
c. The makeup air and transfer air system flow rates modulate as appropriate to match the exhaust rate	<input checked="" type="radio"/> Y / N
d. Appropriate space pressurization is maintained.	<input checked="" type="radio"/> Y / N

**Step 7:**

Press the timed override button. Confirm that system ramps to full speed and back to minimum speed after override times out.	<input checked="" type="radio"/> Y / N
--	--

**Step 8:** Operate all appliances at typical conditions. Apply sample cooking products and/or utilize smoke puffers as appropriate to simulate full load conditions. Confirm that:

a. DCV system automatically ramps to full speed.	<input checked="" type="radio"/> Y / N
b. Hood maintains full capture and containment during ramping to and at full-speed.	<input checked="" type="radio"/> Y / N
c. Appropriate space pressurization is maintained.	<input checked="" type="radio"/> Y / N

<b>B. Testing Results</b>	<b>PASS / FAIL</b>
Step 2: Smoke was fully captured?	<b>Pass</b>
Step 4: All Type I hoods are drawing exhaust at less than or equal to the values in Table 140.9-A.	<b>Pass</b>
Step 6: DCV and MUA system respond (all Yes).	<b>Pass</b>
Step 7: Timed override works	<b>Pass</b>
Step 8: DCV and MUA systems respond to full load conditions (all Yes)	<b>Pass</b>

<b>C. Evaluation :</b>
<input checked="" type="checkbox"/> <b>PASS:</b> All <b>Construction Inspection</b> responses are complete and all <b>Testing Results</b> responses are "Pass"

<b>Notes:</b>



*Let's talk about the changes  
to the Energy Standards –  
Alterations  
(Prescriptive Approach)*



# Fenestration

## 2008 – §149(b)1A

- Replacement and added fenestration must:
  - Meet U-Factor and SHGC reqs. in §143
  - Meet 40% total and west facing area reqs. when glazing is added
    - Exempt from SHGC req. when less than 150 ft<sup>2</sup> of glazing is replaced
    - Exempt from SHGC req. when 50 ft<sup>2</sup> of glazing or less is added

## 2013 – §141.0(b)2A

- Replacement and added fenestration must:
  - Meet U-factor and SHGC reqs. in [TABLE 141.0-A](#)
  - Meet VT reqs. in §140.3
    - Exempt from SHGC and VT reqs. when less than 150 ft<sup>2</sup> of glazing is replaced
    - Exempt from SHGC and VT when 50 ft<sup>2</sup> of glazing or less is added

*TABLE 141.0-A Altered Window Maximum U-Factor and Minimum RSHGC*

<b>Climate Zone</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>
<b>U-factor</b>	0.47	0.47	0.58	0.47	0.58	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
<b>RSHGC</b>	0.41	0.31	0.41	0.31	0.41	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.41
<b>VT</b>	See TABLE 140.3-B, C, and D for all Climate Zones															



## §141.0(b)2A and the Permit Process



- **Verify at permit on [NRCC-ENV-01](#)**
  - Verify efficiency values and glazing area meet reqs.
- **Verify at Final**
  - Replaced/added fen. meets values/areas on NRCC-ENV-01
  - [NRCI-ENV-01](#) form
  - [NRCA-ENV-02](#) req. if site-built fenestration installed





## Re-roofs

### 2008 – §149(b)1B

- When more than 50% or 2,000 ft<sup>2</sup> replaced (whichever is less), must be cool roof
  - Same as prescriptive reqs. for both low-sloped and steep-sloped roofs (new const.)
  - Roof insulation alternative in TABLE 149-A

### 2013 – §141.0(b)2B

- Same threshold criteria
  - Same efficiency reqs. as [prescriptive](#) reqs. for new construction
  - Remember that density criteria was removed
- Solar reflectance trade-off in [TABLE 141.0-B](#)

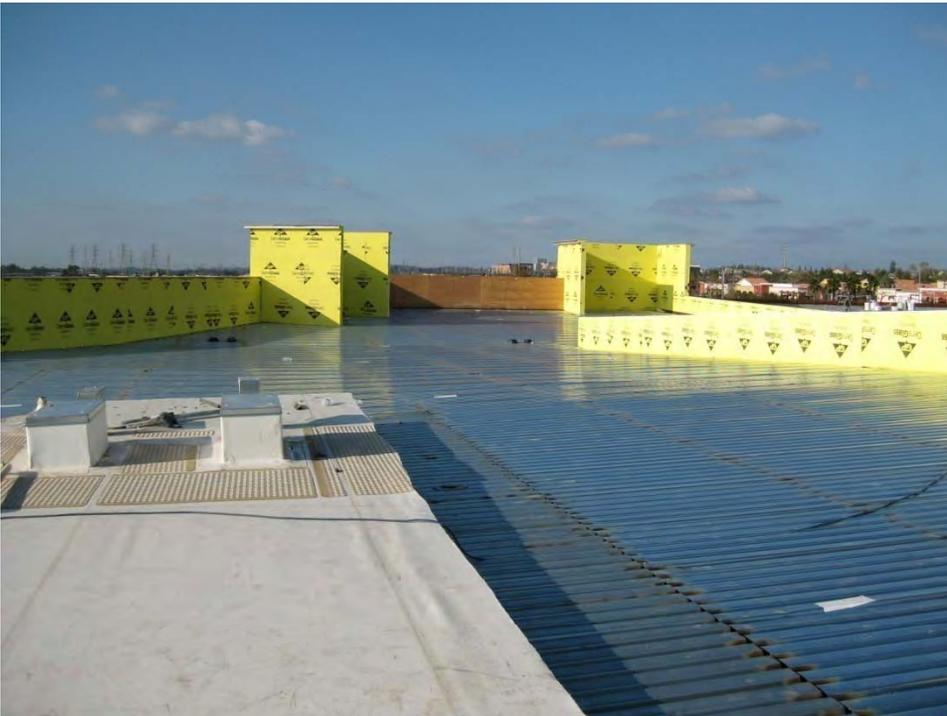
*TABLE 141.0-B Roof/Ceiling Insulation Tradeoff for Aged Solar Reflectance*

Aged Solar Reflectance	Climate Zone 1, 3-9 U-factor	Climate Zone 2, 10-16 U-factor
0.62- 0.60	0.075	0.052
0.59-0.55	0.066	0.048
0.54-0.50	0.060	0.044
0.49-0.45	0.055	0.041
0.44-0.40	0.051	0.039
0.39-0.35	0.047	0.037
0.34-0.30	0.044	0.035
0.29-0.25	0.042	0.034



# §141.0(b)2B and the Permit Process

- **Verify at permit on NRCC-ENV-01 (*Section E*)**
  - Verify SR and TE values meet requirements
  - Verify if alternative is used
- **Verify at Final**
  - Installed cool roof values meet or exceed NRCC-ENV-01
    - (*CRRC product label*)
  - Verify NRCI-ENV-02







# HVAC Alterations

## 2008 – §149(b)1C, D, E

- Reqs. for
  - New space conditioning systems
  - Duct alterations
  - HVAC changeouts
    - Duct leakage testing
    - Acceptance testing
- MECH-1C-ALT from

## 2013 – *§141.0(b)2C, D, E*

- Reqs./criteria for all HVAC alterations did not change
- Acceptance testing will need to be performed by a CMATT when req.
- Forms will need to be registered starting 1/1/15
- NRCC-MCH-ALT form under development



## §141.0(b)2C, D, E and the Permit Process

- **Verify at permit on NRCC-MCH-ALT**
  - Should verify HVAC type and req. Acceptance tests
- **Verify at Final:**
  - [NRCA-MCH-02](#) (new systems)
  - NRCA-MCH-04 and [NRCV-MCH-04](#) (duct leakage)
  - [NRCA-MCH-05](#) (economizers)
    - NRCA forms must be signed by CMATT when req.



*\* Forms must be registered starting 1/1/15*

# OUTDOOR AIR ACCEPTANCE



CERTIFICATE OF ACCEPTANCE		NRCA-MCH-02-A
Outdoor Air Acceptance		(Page 2 of 3)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: 010113
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

3 complete air changes to the zone served by the air handler.

NA7.5.1.1 Outdoor Air Acceptance		
A. Functional Testing (Check appropriate column)	<input checked="" type="checkbox"/> CAV	<input type="checkbox"/> VAV
<b>Step 1: Verify unit is not in economizer mode during test (economizer disabled).</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<i>Note: Shaded boxes do not apply for CAV systems</i>		
<b>Step 2: CAV and VAV testing at full supply airflow</b>		
a. Adjust supply air to achieve design airflow or maximum airflow at full cooling. Record VFD speed (Hz).		Hz
b. Measured outdoor airflow reading (cfm)	<b>325</b> cfm	cfm
c. Required outdoor airflow (cfm) (from MECH-3C, Column I, or Mechanical Equipment Schedules).	<b>300</b> cfm	cfm
d. Time for outside air damper to stabilize after full supply airflow is achieved (minutes):		min
<b>Step 3: VAV testing at reduced supply airflow</b>	<b>CAV</b>	<b>VAV</b>
a. Adjust supply airflow to either the sum of the minimum zone airflows, full heating, or 30% of the total design airflow. Record VFD speed (Hz).		Hz
b. Measured outdoor airflow reading (cfm)		cfm
c. Required outdoor airflow (cfm) (from MECH-3C, Column I, or mechanical equipment schedules).		cfm
d. Time for outside air damper to stabilize after reduced supply airflow is achieved (minutes):		min
<b>Step 4: Return to initial conditions (check)</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

B. Testing Calculations & Results		
Determine Percent Outside Air at full supply airflow (%OA <sub>FA</sub> ) for Step 2		
a. %OA <sub>FA</sub> = Measured outdoor airflow reading / Required outdoor airflow (Step2b/Step2c)	<b>108</b> %	%
b. %OA <sub>FA</sub> is within 10% of design Outside Air. (90% ≤ %OA <sub>FA</sub> ≤ 110%)	(Y) / N	Y / N
c. Outside air damper position stabilizes within 5 minutes (Step 2d < 5 minutes)		Y / N
Determine Percent Outside Air at reduced supply airflow (%OA <sub>RA</sub> ) for Step 3 (VAV only)		
a. %OA <sub>RA</sub> = Measured outdoor airflow reading / Required outdoor airflow reading (Step3b/Step3c)		%
b. %OA <sub>RA</sub> is within 10% of design Outside Air. (90% ≤ %OA <sub>RA</sub> ≤ 110%)		Y / N
c. Outside air damper position stabilizes within 5 minutes (Step 3d < 5 minutes)		Y / N
Note: The intent of this test is to ensure that 1) all air handlers provide the minimum amount of OSA and 2) VAV air handlers use dynamic controls to avoid over ventilation.		

C.	Evaluation :
<input checked="" type="checkbox"/>	PASS: All <b>Construction Inspection</b> responses are complete and <b>Testing Calculations &amp; Results</b> responses are positive (Y - yes)

**DUCT LEAKAGE DIAGNOSTIC TEST**

CEC-NRCV-MCH-04-H (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF VERIFICATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 1 of 2)
Project Name: <b>2013 CALBO Training Sample</b>	Enforcement Agency: <b>Local Jurisdiction</b>	Permit Number: <b>010113</b>
Project Address: <b>2013 CALBO Drive</b>	City: <b>Sacramento</b>	Zip Code: <b>95814</b>

A. System Information		
01	HVAC System Identification or Name:	<b>HVAC 1</b>
02	HVAC System Location or Area Served:	<b>First Floor</b>
03	Verified Low Leakage Air-handling Unit Credit from NRCC-PRF-01-E?	<b>N/A</b>
04	Duct System Compliance Category:	<b>Alteration</b>

B. Duct Leakage Diagnostic Test - MCH-04d - Alteration		
01	Condenser Nominal Cooling Capacity (ton)	<b>2.5 tons</b>
02	Heating Capacity (kBtu/h)	<b>80,000 Btu/h</b>
03	Leakage Factor ( )	<b>.15</b>
04	Air-Handling Unit Airflow (AHU Airflow) Determination Method	<b>Cooling System Method</b>
05	Calculated Target Allowable Duct Leakage Rate (cfm)	<b>150 cfm</b>
06	Actual duct leakage rate from leakage test measurement (cfm)	<b>100 cfm</b>
07	Compliance statement: <b>System Passes Leakage Test</b>	

C. ADDITIONAL REQUIREMENTS FOR COMPLIANCE		
<b>The responsible persons signature on this document indicates the installation complies with the following requirements:</b>		
01	System was tested in its normal operation condition. No temporary taping allowed.	
02	All supply and return register boots were sealed to the drywall.	
03	If cloth backed tape was used it was covered with Mastic and draw bands.	
04	All connection points between the air handler and the supply and return plenums are completely sealed.	
05	For all supply and return registers, verify that the spaces between the register boot and the interior finishing wall are properly sealed.	



# Lighting Alterations

## 2008 – §149(b)11

- Must meet mandatory and prescriptive reqs. for alterations:
  - That increase the lighting load (watts/ft<sup>2</sup>)
  - Where 50% or more of the lighting fixtures are replaced, removed, or re-installed
- Must meet mandatory reqs. for wiring alterations

## 2013 – §141.0(b)21

- Lighting system alterations must meet reqs. in TABLE 141.0-E
  - Threshold criteria of 10% for altered fixtures
- Luminaire modifications-in-place must meet reqs. in TABLE 141.0-F
  - Threshold criteria of 40 luminaires for altered fixtures
- Acceptance test by CLCATT

- ii. If the new ducts are an extension of an existing duct system, the combined new and existing duct system shall meet one of the following requirements:
  - a. The measured duct leakage shall be equal to or less than 15 percent of the system air handler airflow as confirmed by field verification and diagnostic testing utilizing the procedures in Reference Nonresidential Appendix Section NA2.1.4.2.1; or
  - b. If it is not possible to comply with the duct leakage criterion in Subsection 141.0(b)2Diia, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test performed by a certified HERS Rater utilizing the methods specified in Reference Nonresidential Appendix NA2.1.4.2.2.

**EXCEPTION to Section 141.0(b)2Dii: Duct Sealing.** Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos are exempt from the requirements of subsection 141.0(b)2Dii.

- E. **Altered Space-Conditioning Systems.** When a space-conditioning system is altered by the installation or replacement of space-conditioning system equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil):
  - i. For all altered units where the existing thermostat does not comply with Reference Joint Appendix JA5, the existing thermostat shall be replaced with a thermostat that complies with Reference Joint Appendix JA5. All newly installed space-conditioning systems requiring a thermostat shall be equipped with a thermostat that complies with Reference Joint Appendix JA5; and
  - ii. The duct system that is connected to the new or replaced space-conditioning system equipment shall be sealed, if the duct system meets the criteria of Sections 140.4(l)1, 2 and 3, as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures for duct sealing of altered existing duct systems as specified in Reference Nonresidential Appendix NA2, and conforming to the applicable leakage compliance criteria in Section 141.0(b)2D.

**EXCEPTION 1 to Section 141.0(b)2E: Duct Sealing.** Buildings altered so that the duct system no longer meets the criteria of Sections 144 (l)1, 2, and 3 are exempt from the requirements of Subsection 141.0(b)2E.

**EXCEPTION 2 to Section 141.0(b)2E: Duct Sealing.** Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in the Reference Nonresidential Appendix NA2 are exempt from the requirements of Subsection 141.0(b)2E.

**EXCEPTION 3 to Section 141.0(b)2E: Duct Sealing.** Existing duct systems constructed, insulated or sealed with asbestos are exempt from the requirements of Subsection 141.0(b)2E.

- F. Spaces with lighting systems installed for the first time shall meet the requirements of Sections 110.9, 130.0, 130.1, 130.2, 130.4, 130.5, 140.3(c), 140.6, and 140.7.
- G. When the requirements of Section 130.1(d) are triggered by the addition of skylights to an existing building and the lighting system is not re-circuited, the daylighting control need not meet the multi-level requirements in Section 130.1(d).
- H. New internally and externally illuminated signs shall meet the requirements of Sections 110.9, 130.3 and 140.8.

**I. For each enclosed space, alterations to existing indoor lighting shall meet the following requirements:**

- i. **Luminaire Classification and Power** shall be determined in accordance with Section 130.0(c).

**EXCEPTION to Section 141.0(b)2Ii:** For only a Lighting System Alteration in accordance with Section 141.0(b)2Iii, or a Luminaire Modifications-in-Place in accordance with Section 141.0(b)2Iiii; an existing incandescent, fluorescent or HID luminaire may be modified and classified as a luminaire having a different number of, or type of light source(s), provided all of the following conditions are met:

- a. The luminaire has been previously used and is in an existing installation; and,

- b. The modified luminaire is listed with the different number or type of light source(s) under the installed conditions; and
- c. The different light source(s) is not an LED lamp, integrated or nonintegrated type, as defined by ANI/IES RP-16-2010; and
- d. The modified luminaire does not contain:
  - 1. Unused fluorescent or HID ballast(s); or
  - 2. Unused HID or fluorescent lamp sockets; or
  - 3. Sockets used only for lamp support; or
  - 4. Screw sockets of any kind or for any purpose; and
- e. The wattage of the modified luminaire shall be published in the manufacturer's catalog based on accredited testing lab reports.

ii. **Lighting System Alterations** shall meet the applicable requirements in TABLE 141.0-E and the following:

- a. Lighting System Alterations include alterations where an existing lighting system is modified, luminaires are replaced, or luminaires are disconnected from the circuit, removed and reinstalled, whether in the same location or installed elsewhere.

**EXCEPTION 1 to Section 141.0(b)2Iii:** Alterations that qualify as a Luminaire Modification-in-Place.

**EXCEPTION 2 to Section 141.0(b)2Iii:** Portable luminaires, luminaires affixed to moveable partitions, and lighting excluded in accordance to Section 140.6(a)3.

iii. **Luminaire Modifications-in-Place** shall meet the applicable requirements in TABLE 141.0-F and the following:

- a. To qualify as a Luminaire Modification-in-Place, luminaires shall only be modified by one or more of the following methods:
  - 1. Replacing lamps and ballasts with like type or quantity in a manner that preserves the original luminaire listing.
  - 2. Changing the number or type of light source in a luminaire including: socket renewal, removal or relocation of sockets or lampholders, and/or related wiring internal to the luminaire including the addition of safety disconnecting devices.
  - 3. Changing the optical system of a luminaire in part or in whole.
  - 4. Replacement of whole luminaires one for one in which the only electrical modification involves disconnecting the existing luminaire and reconnecting the replacement luminaire.
- b. Luminaire Modifications-In-Place shall include only alterations to lighting system meeting the following conditions:
  - 1. Luminaire Modifications-in-Place shall not be part of or the result of any general remodeling or renovation of the enclosed space in which they are located.
  - 2. Luminaire Modifications-in-Place shall not cause, be the result of, or involve any changes to the panelboard or branch circuit wiring, including line voltage switches, relays, contactors, dimmers and other control devices providing power to the lighting system.

**EXCEPTION to Section 141.0(b)2Iiii2.** Circuit modifications strictly limited to the addition of occupancy or vacancy sensors and class two lighting controls are permitted for Luminaire Modifications-in-Place

iv. **Lighting Wiring Alterations** shall meet the applicable requirements in Sections 110.9, 130.1, and 130.4.

a. Lighting Wiring Alterations include the following:

1. Adding a circuit feeding luminaires.
2. Modifying or relocating wiring to provide power to new or relocated luminaires.
3. Replacing wiring between a switch or panelboard and luminaire(s).
4. Replacing or installing a new panelboard feeding lighting systems.

**EXCEPTION to Section 141.0(b)2Iiv.** Lighting Wiring Alterations allowed for Luminaire Modifications-in-Place in accordance with Section 141.0(b)2Iiii.

- v. Any lighting alteration that increases the installed lighting power in an enclosed space shall meet the requirements of Sections 110.9, 130.0, 130.1, 130.4, 140.3(c) and 140.6.
- vi. Lighting Alterations and Luminaire Modifications-in-Place shall not exceed the lighting power allowance in Section 140.6.
- vii. The following indoor lighting alterations are not required to comply with the lighting requirements in Title 24, Part 6:
  - a. Replacement in kind of parts of an existing luminaire that include only new lamps, lamp holders, or lenses, when replacement of those parts is not a Luminaire-Modification-in-Place in accordance with Section 141.0(b)2Iiii.
  - b. Lighting Alterations directly caused by the disturbance of asbestos.

**EXCEPTION to Section 141.0(b)2Iviiib:** Lighting alterations made in conjunction with asbestos abatement shall comply with the applicable requirements in Section 141.0(b)2I.

- J. Alterations to existing outdoor lighting systems shall meet the following requirements:
  - i. Alterations that increase the connected lighting load in a lighting application listed in TABLE 140.7-A or 140.7-B shall meet the applicable requirements of Sections 130.0, 130.2, 130.4, and 140.7; and
  - ii. In alterations that replace 10 percent or more of the luminaires in a lighting application listed in TABLE 140.7-A or 140.7-B, the altered luminaires shall meet the applicable requirements of Sections 130.0, 130.2 and 130.4; and
  - iii. In alterations that replace more than 50 percent of the luminaires in a lighting application listed in TABLE 140.7-A or 140.7-B, the lighting in that application shall meet the applicable requirements of Sections 130.0, 130.2, 130.4 and 140.7.
- K. Alterations to existing internally and externally illuminated signs that increase the connected lighting load, replace and rewire more than 50 percent of the ballasts, or relocate the sign to a different location on the same site or on a different site shall meet the requirements of Section 140.8
- L. Replacement of parts of an existing sign, including replacing lamps, the sign face or ballasts, that do not require rewiring or that are done at a time other than when the sign is relocated, is not an alteration subject to the requirements of Section 141.0(b)2K.
- M. Service water-heating systems shall meet the requirements of Section 140.5,-except for the solar water heating requirements.
- N. A building shell for which interior walls or ceilings are installed for the first time shall meet the requirements of Section 140.3(c)

### 3. Performance approach.

- A. The altered envelope, space-conditioning system, lighting and water heating components, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 120.0 through 120.6, and Sections 120.8 through 130.5.

**EXCEPTION to Section 141.0(b)3A Window Films.** Applied window films installed as part of an alteration complies with the U-factor, RSHGC and VT requirements of TABLE 141.0-D.

*TABLE 141.0-E Requirements for Luminaire Alterations*

Quantity of existing affected luminaires per Enclosed Space <sup>1</sup>	Resulting Lighting Power for Each Enclosed Space	Applicable Mandatory Control Provisions for Each Enclosed Space	Multi-level Lighting Control Requirements for Each Altered Luminaire
<b>Alterations that do not change the area of the enclosed space or the space type</b>			
Sum total < 10% of existing luminaires	Existing lighting power is permitted	Existing provisions are permitted	Existing controls are permitted
Sum total ≥ 10% of existing luminaires	≤ 85% of allowed lighting power per Section 140.6 Area Category Method	§130.1(a), (c)	Two level lighting control <sup>2</sup> or §130.1(b)
	> 85% of allowed lighting power per Section 140.6 Area Category Method	§130.1(a), (c), (d) <sup>3</sup>	§130.1(b)
<b>Alterations that change the area of the enclosed space or the space type or increase the lighting power in the enclosed space</b>			
Any number	Comply with Section 140.6	§130.0(d) <sup>3</sup> §130.1(a), (c), (d) <sup>3</sup> , (e)	§130.1(b)
<p>1. Affected luminaires include any luminaire that is changed, replaced, removed, relocated; or, connected to, altered or revised wiring, except as permitted by EXCEPTIONS 1 and 2 to Section 141.0(b)<b>2Iii:</b></p> <p>2. Two level lighting control shall have at least one control step between 30 percent and 70 percent of design lighting power in a manner providing reasonably uniform illuminations</p> <p>3. Daylight controls in accordance with Section 130.0(d) are required only for luminaires that are altered.</p>			

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

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

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

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

1. Control requirements only apply to enclosed spaces for which there are Luminaire Modifications-in-Place.
2. Multi-level controls are required only for luminaires for which there are Luminaire Modifications-in-Place.
3. Two level lighting control shall have at least one control step between 30 percent and 70 percent of design lighting power in a manner providing reasonably uniform illuminations.
4. Daylight controls in accordance with Section 130.0(d) are required only for luminaires that are modified-in-place.



# §141.0(b)2I and the Permit Process

- **Verify at permit req. Certificate of Compliance**
  - NRCC-LTI-01 (all alt.)
  - [NRCC-LTI-02](#) (mandatory)
  - [NRCC-LTI-03](#) (watts/ft<sup>2</sup>)
  - Must match specs. on electrical plans
- **Verify at Final req. NRCI and NRCA forms**
  - [NRCI-LTI-05](#) (PAF)
  - [NRCA-LTI-02](#) (Controls)







## For more information

- **2013 Standards Website at:**
  - <http://www.energy.ca.gov/title24/2013standards/index.html>
- **CEC training (ICC Chapters)**
  - Contact Energy Standards Hotline at: [Title24@energy.ca.gov](mailto:Title24@energy.ca.gov)
- **Utility training**
  - <http://www.energy.ca.gov/title24/training/>
- **HERS training (Building Departments)**
  - <http://www.energy.ca.gov/HERS/providers.html>
- **Ace Web Toolkit**
  - <http://energydesignresources.com/resources/software-tools/ace-tools.aspx>