

10 101 to 10 114 Energy Building Regulations

ARTICLE 1 – ENERGY BUILDING REGULATIONS

SECTION 10-101 – SCOPE

- (a) This article contains administrative regulations relating to the energy building regulations in Title 24, Part 6. This article applies to all residential and nonresidential buildings.
- (b) Nothing in this article lessens any necessary qualifications or responsibilities of licensed or registered building professionals or other designers or builders, or the duties of enforcement agencies that exist under state or local law.

NOTE: Authority cited: Sections 25402 and 25402.1, Public Resources Code. Reference: Sections 25402 and 25402.1, Public Resources Code.

SECTION 10-102 – DEFINITIONS

In this article the following definitions apply:

ACCEPTANCE REQUIREMENTS are "acceptance requirements for code compliance" as defined in Section 100.1(b) of Part 6.

ACM means ALTERNATIVE CALCULATION METHOD.

~~(ACM) APPROVAL MANUALS or ACM APPROVAL MANUAL are the documents establishing the requirements for Energy Commission approval of performance software used to show compliance with the Building Energy Efficiency Standards for Residential and Nonresidential Buildings, California Energy Commission Publication Numbers CEC-400-2012-002-CMF and CEC-400-2012-003-CMF. is the Alternative Calculation Method (ACM) Approval Manual for the Energy Efficiency Standards for Nonresidential Buildings, for nonresidential buildings, hotels, and multi-family residential buildings with four or more stories and the Alternative Calculation Method (ACM) Approval Manual for the Energy Efficiency Standards for Residential Buildings, for all single family and low-rise multi-family residential buildings.~~

ACM)-REFERENCE MANUAL is the document establishing the procedures required to implement Sections 140.1 and 150.1 of Title 24, Part 6 of the California Code of Regulations in Compliance Software.

ALTERNATIVE COMPONENT PACKAGE is a set of building measures whose aggregate calculated energy use is less than or equal to the maximum allowed Energy Budget.

APPLIANCE EFFICIENCY REGULATIONS are the regulations in Title 20, Section 1601 et. Sseq. of the California Code of Regulations.

APPROVED CALCULATION METHOD is compliance software, or alternative component packages, or exceptional methods a Public Domain Computer Program approved under Section 10-109(a), ~~or any Alternative Calculation Method approved under Section 10-109(b).~~

BUILDING ENERGY EFFICIENCY STANDARDS are those regulations contained in Title 24, Part 6 of the California Code of Regulations.

BUILDING PERMIT is an electrical, plumbing, mechanical, building, or other permit or approval, that is issued by an enforcement agency, and that authorizes any construction that is subject to Part 6.

CALIFORNIA ENERGY COMMISSION is the California State Energy Resources Conservation and Development Commission.

COMMISSION is the California State Energy Resources Conservation and Development Commission.

COMPLIANCE APPROACH is any one of the allowable methods by which the design and construction of a building may be demonstrated to be in compliance with Part 6. The compliance approaches are the performance compliance approach and the prescriptive compliance approach. The requirements for each compliance approach are set forth in Section 100.0(e)2 of Part 6.

COMPLIANCE DOCUMENT is any of the documents specified in Section 10-103(a) utilized to demonstrate compliance with Part 6 (i.e., Certificate of Compliance, Certificate of Installation, Certificate of Acceptance, and Certificate of Verification).

COMPLIANCE OPTION is a procedure for demonstrating compliance with Part 6 that has been approved pursuant to [Appropriate section].

CONDITIONED FLOOR AREA is the “conditioned floor area” as defined in Section 100.1(b) of Part 6.

CRRC-1 is the Cool Roof Rating Council document entitled “Product Rating Program”.

DATA REGISTRY is a web service with a user interface and database maintained by a Registration Provider that complies with the applicable requirements in Reference Joint Appendix JA7, with guidance from the Data Registry Requirements Manual, and provides for registration of residential or nonresidential compliance documentation used for demonstrating compliance with Part 6.

RESIDENTIAL DATA REGISTRY is a data registry that is maintained by a HERS Provider, that provides for registration, when required by Part 6, of all residential compliance documentation and the nonresidential Certificate of Verification.

NONRESIDENTIAL DATA REGISTRY is a data registry that is maintained by a HERS Provider or a Registration Provider approved by the Commission, that provides for registration, when required by Part 6, of all nonresidential compliance documentation. However, nonresidential data registries may not provide for registration of nonresidential Certificates of Verification.

DATA REGISTRY REQUIREMENTS MANUAL is a document that provides additional detailed guidance regarding the functional and technical aspects of the data registry requirements given in Joint Appendix JA7.

DOCUMENTATION AUTHOR is a person who prepares a Title 24 Part 6 compliance document that must subsequently be reviewed and signed by a responsible person in order to certify compliance with Part 6.

ENERGY BUDGET is the “energy budget” as defined in Section 100.1(b) of Part 6.

ENERGY COMMISSION is the California State Energy Resources Conservation and Development Commission.

ENFORCEMENT AGENCY is the city, county, or state agency responsible for issuing a building permit.

EXCEPTIONAL METHOD is a method for estimating the energy performance of building features that cannot be adequately modeled using the public domain computer programs and that is approved by the Executive Director.

EXECUTIVE DIRECTOR is the executive director of the Commission.

FIELD TECHNICIAN is a person who performs acceptance tests in accordance with the specifications in Reference Joint Appendix NA7, and reports the results of the acceptance tests on the Certificate of Acceptance in accordance with the requirements of Section 10-103(a)4.

HERS is the California Home Energy Rating System as described in Title 20, Chapter 4, Article 8, Section 1670.

HERS PROVIDER is an organization that administers a home energy rating system as described in Title 20, Chapter 4, Article 8, Section 1670.

HERS PROVIDER DATA REGISTRY is a data registry maintained by a HERS provider.

HERS RATER is a person who has been trained, tested, and certified by a HERS Provider to perform the field verification and diagnostic testing required for demonstrating compliance with the Part 6, as described in TITLE 20, Chapter 4, Article 8, Section 1670(i).

HVAC SYSTEM is the “HVAC system” as defined in Section 100.1(b) of Part 6.

MANUFACTURED DEVICE is the “manufactured device” as defined in Section 100.1(b) of Part 6.

NFRC 100 is the National Fenestration Rating Council document entitled “NFRC 100: Procedure for Determining Fenestration Product U-factors.” (20072010); NFRC 100 includes procedures for the Component Modeling Approach (CMA) and site built fenestration formerly included in a separate document, NFRC 100-SB.)

NFRC 200 is the National Fenestration Rating Council document entitled “NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence.” (20072010). ~~NFRC 200 includes procedures for the Component Modeling Approach (CMA).~~

NFRC 202 is the National Fenestration Rating Council document entitled “NFRC 202: Procedures for Determining Translucent Fenestration Product Visible Transmittance at Normal Incidence.” (2011).

NFRC 400 is the National Fenestration Rating Council document entitled “NFRC 400: Procedure for Determining Fenestration Product Air Leakage.” (20072010).

NSHP GUIDEBOOK is the California Energy Commission document entitled “New Solar Home Partnership Guidebook” ~~that is in effect at the time of application for the building permit.~~

PART 6 is Title 24, Part 6 of the California Code of Regulations.

PUBLIC ADVISER is the Public Adviser of the Commission.

R-VALUE is the measure of the thermal resistance of insulation or any material or building component expressed in ft²-hr-°F/Btu.

RECORD DRAWINGS are drawings that document the as installed location and performance data on all lighting and space conditioning system components, devices, appliances and equipment, including but not limited to wiring sequences, control sequences, duct and pipe distribution system layout and sizes, space conditioning system terminal device layout and air flow rates, hydronic system and flow rates, and connections for the space conditioning system. Record drawings are sometimes called “as built.”

~~**REFERENCE APPENDICES** is are the support document for the Building Energy Efficiency Standards and the ACM Approval Manuals. The document consists of three sections: the Reference Joint Appendices (JA), the Reference Residential Appendices (RA), and the Reference Nonresidential Appendices (NA).~~

REFERENCE JOINT APPENDICES is Commission Publication No. XXX-XXXX-XXX-XXX.

REFERENCE NONRESIDENTIAL APPENDICES is Commission Publication No. XXX-XXXX-XXX-XXX.

REFERENCE RESIDENTIAL APPENDICES is Commission Publication No. XXX-XXXX-XXX-XXX.

REGISTERED DOCUMENT is a document that has been submitted to a residential or nonresidential data registry for retention, and the data registry has assigned a unique registration number to the document.

REGISTRATION PROVIDER is an organization that administers a data registry service that conforms to the requirements in Reference Joint Appendix JA7.

STANDARD DESIGN BUILDING is a “Standard Design Building” as defined in Section 100.1(b) of Part 6.

NOTE: Authority cited: Sections 25402 and 25402.1, Public Resources Code. Reference: Sections 25402 and 25402.1, Public Resources Code.

SECTION 10-103 – PERMIT, CERTIFICATE, INFORMATIONAL, AND ENFORCEMENT REQUIREMENTS FOR DESIGNERS, INSTALLERS, BUILDERS, MANUFACTURERS, AND SUPPLIERS

- (a) **Documentation.** The following documentation is required to demonstrate compliance with Part 6. This documentation shall meet the requirements of Section 10-103(a) or alternatives approved by the Executive Director.

1. **Certificate of Compliance.** For all buildings, the Certificate(s) of Compliance described in Section 10-103 shall be signed by the person(s) in charge of the building design, who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design (*responsible person*); and submitted in accordance with Sections 10-103(a)1 and 10-103(a)2 to certify conformance with Part 6. If more than one person has responsibility for the building design, each person shall sign the Certificate of Compliance document(s) applicable to that portion of the design for which the person is responsible. Alternatively, the person with chief responsibility for the building design shall prepare and sign the Certificate of Compliance document(s) for the entire building design. Subject to the requirements of Sections 10-103(a)1 and 10-103(a)2, persons who prepare Certificate of Compliance documents (*documentation authors*) shall sign a declaration statement on the documents they prepare to certify the information provided on the documentation is accurate and complete. The In accordance with applicable requirements of 10-103(a)1, the signatures provided by responsible persons and documentation authors shall be original signatures on paper documents or electronic signatures on electronic documents conforming to the electronic signature specifications in Reference Joint Appendix JA7.

For all Nonresidential buildings, the Design Review Kickoff Certificate(s) of Compliance, and Construction Document Design Review Checklist Certificate(s) of Compliance shall be completed and signed by a licensed professional engineer. For buildings less than 10,000 ft², the licensed professional engineer may be the engineer of record. For buildings greater than 10,000 ft² but less than 50,000 ft², the licensed professional engineer shall be a qualified in-house engineer with no other project involvement or a third party engineer. For buildings greater than 50,000 ft² and all buildings with complex mechanical systems serving more than 10,000 ft², the licensed professional engineer shall be a third party.

A. All Certificate of Compliance documentation shall conform to a format and informational order and content approved by the Energy Commission.

These documents shall:

- i. Identify the energy features, performance specifications, materials, components, and manufactured devices required for compliance with Part 6.
- ii. Identify the building project name and address. The building project name and address identification on the Certificate of Compliance shall be consistent with the building project name and address identification given on the other applicable building design plans and specifications submitted to the enforcement agency for approval with the building permit application.
- iii. Display the unique registration number assigned by the data registry if Section 10-103(a)1 requires the document to be registered.
- iv. Include a declaration statement to the effect that the building energy features, performance specifications, materials, components, and manufactured devices for the building design identified on the Certificate of Compliance indicate the building is in compliance with the requirements of Title 24, Parts 1 and 6, and the building design features identified on the Certificate of Compliance are consistent with the building design features identified on the other applicable compliance documents, worksheets, calculations, plans, and specifications submitted to the enforcement agency for approval with the building permit application.
- v. Be signed by the documentation author to certify the documentation is accurate and complete. When document registration is required by Section 10-103(a)1, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
- vi. Be signed by the responsible person eligible under Division 3 of the Business and Professions Code to accept responsibility for the design to certify conformance with Part 6. When document registration is required by Section 10-103(a)1, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7. For newly constructed low rise residential buildings demonstrating compliance under the Section 151(c)2 multiple orientation alternative for which compliance requires HERS field verification, the person(s) responsible for the Certificate(s) of Compliance shall submit the Certificate(s) for retention to a HERS provider data registry. Submittals to the HERS provider data registry shall be made electronically.

~~B. Beginning on October 1, 2010, for~~ For all low-rise residential buildings for which compliance requires HERS field verification, the person(s) responsible for the Certificate(s) of Compliance shall submit the Certificate(s) for registration and retention to a HERS provider data registry. The submittals to the HERS provider data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Compliance documents that are registered and retained by a HERS provider data registry shall also be automatically transmitted by the data registry, to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

~~C. For alterations to existing residential buildings for which HERS field verification is not required such as water heater and window replacements, and for additions to existing residential buildings that are less than 300 square feet for which HERS field verification is not required, the enforcement agencies may at their discretion not require any Certificate of Compliance documentation, or may develop simplified Certificate of Compliance documentation for demonstrating compliance with the Standards.~~

Exemptions from submitting compliance documentation shall not be deemed to grant authorization for any work to be done in any manner in violation of this code or other provisions of law.

~~D. Beginning on January 1, 2015, contingent upon approval of data registry(s) by the Commission, all nonresidential buildings, high-rise residential buildings, and hotels and motels, when designated to allow use of an occupancy group or type regulated by Part 6, the person(s) responsible for the Certificate(s) of Compliance shall submit the Certificate(s) for registration and retention to a HERS provider data registry, or a data registry approved by the Commission. The submittals to the HERS provider data registry or approved data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.~~

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Compliance documents that are registered and retained by a HERS provider data registry or approved data registry shall also be automatically transmitted by the data registry, to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

~~Subject to the requirements of this section, persons who prepare energy compliance documentations shall sign a statement that the documentation is accurate and complete.~~

2. **Application for a building permit.** Each application for a building permit subject to Part 6, shall contain at least one copy of the documents ~~listed specified~~ in Sections 10-103(a)2A, 10-103(a)2B, and 10-103(a)2C.

~~A. For all newly constructed buildings, additions, alterations, or repairs regulated by Part 6, the applicant shall submit the applicable Certificate(s) of Compliance to the enforcement agency for approval. file the applicable Certificate(s) of Compliance on the plans. The certificate(s) shall indicate the features and performance specifications needed to comply with Part 6 conform to the requirements of Section 10-103(a)1, and shall be approved by the local enforcement agency, in accordance with all applicable requirements of Section 10-103(d), by stamp or authorized signature prior to issuance of a building permit. A copy of the Certificate(s) of Compliance shall be included with the documentation the builder provides to the building owner at occupancy as specified in Section 10-103(b).~~

For alterations to existing residential buildings for which HERS field verification is required, and when the enforcement agency does not require building design plans to be submitted with the application for a building permit, the applicable Certificate of Compliance documentation specified in 10-103(a)1 is not required to be approved by the enforcement agency prior to issuance of a building permit, but shall be approved by the enforcement agency prior to final inspection of the dwelling unit, and shall be made available to the enforcement agency for all applicable inspections.

~~For newly constructed low-rise residential buildings demonstrating compliance under the Section 151(e)2 multiple orientation alternative for which compliance requires HERS field verification, the certificate that appears on the plans shall be a copy of the registered Certificate of Compliance from a HERS provider data registry.~~

~~When the enforcement agency requires building design plans to be submitted with the application for a building permit, the applicable Certificate of Compliance documents shall be incorporated into the building design plans. Beginning on October 1, 2010, for~~ When all low-rise residential buildings for which Section 10-103(a)1 compliance requires HERS field verification, document registration, the certificate(s) that appears on ~~are incorporated into the building design plans shall be copies a copy~~ of the registered Certificate of Compliance ~~documents~~ from a HERS provider data registry, or a data registry approved by the Commission.

~~The Certificate(s) of Compliance and supporting documentation shall be readily legible and of substantially similar format and informational order and content to the applicable Certificate(s) of Compliance and supporting documentation in the applicable Residential or Nonresidential Compliance Manual, as defined in Part 6.~~

- B. ~~Plans~~ When the enforcement agency requires building design plans and specifications ~~to be~~ submitted with ~~each the~~ application for a building permit, ~~the plans~~ shall ~~show conform to the specifications for the characteristics of each~~ features, materials, components, and manufactured devices identified on the Certificate(s) of Compliance, proposed to be installed in order to have the building meet the and shall conform to all other applicable requirements of Part 6, ~~and of Plans and specifications shall be submitted to the enforcement agency for~~ any other feature, material, component, or manufactured device that Part 6 requires be indicated on the building design plans and specifications. Plans and specifications submitted with each application for a building permit for Nonresidential buildings, High-rise Residential buildings and Hotels and Motels shall provide acceptance requirements for code compliance of each feature, material, component or manufactured device when acceptance requirements are required under Part 6. Plans and specifications for Nonresidential buildings, High-rise Residential buildings and Hotels and Motels shall require, and indicate with a prominent note on the plans, that within 90 days after the Enforcement Agency issues a permanent final occupancy permit, record drawings be provided to the building owner.

~~If~~ For all buildings, if the specification for any a building design feature, material, component, or manufactured device characteristic is materially changed before final construction ~~and or~~ installation, such that the building may no longer comply with Part 6, the building must be brought back into compliance, and so indicated on amended plans, specifications, and Certificate(s) of Compliance that shall be submitted to the enforcement agency for approval. Such characteristics shall include the efficiency (or other characteristic regulated by Part 6) of each building design feature, material, component, or device.

- C. ~~All~~ The enforcement agency shall have the authority to require submittal of any supportive documentation that was used to generate the Certificate(s) of Compliance, including but not limited to the electronic input file for the compliance software tool that was used to generate performance method Certificate(s) of Compliance; or any other supportive documentation that is necessary to demonstrate compliance for that the building design conforms to the requirements and of the sections of Part 6, with which the building is intended to comply shall be submitted with each application for a building permit. The forms used to demonstrate compliance shall be readily legible and of substantially similar format and informational order and content to the applicable forms in the Residential or Nonresidential Compliance Manual, as defined in Part 6.

3. ~~Installation Certificate of Installation and Certificate of Acceptance.~~

- A. ~~Installation Certificate.~~ For all buildings, the person in charge of the construction or installation, who is eligible under Division 3 of the Business and Professions Code to accept responsibility with overall responsibility for construction or the person(s) responsible for the construction or installation of features, materials, components, or manufactured devices regulated by Part 6 or the Appliance Efficiency Regulations (responsible person) shall sign and submit Installation Certificate of Installation documentation (s) as specified in this section Section 10-103(a)3 to certify conformance with Part 6. If more than one person has responsibility for the construction or installation, each person shall sign and submit the Certificate of Installation documentation applicable to the portion of the construction or installation for which they are responsible; alternatively, the person with chief responsibility for the construction or installation shall sign and submit the Certificate of Installation documentation for the entire construction or installation scope of work for the project. Subject to the requirements of Section 10-103(a)3, persons who prepare Certificate of Installation documentation (documentation authors) shall sign a declaration statement on the documents they prepare to certify the information provided on the documentation is accurate and complete. In accordance with applicable requirements of 10-103(a)3, the signatures provided by responsible

persons and documentation authors shall be original signatures on paper documents or electronic signatures on electronic documents conforming to the electronic signature specifications in Reference Joint Appendix JA7.

A. All Certificate of Installation documentation shall conform to a format and informational order and content approved by the Energy Commission.

These documents shall:

- i. Identify the features, materials, components, manufactured devices, and system performance diagnostic results required to demonstrate compliance with Part 6 and the Appliance Efficiency regulations.
- ii. State the number of the building permit under which the construction or installation was performed.
- iii. Display the unique registration number assigned by the data registry if Section 10-103(a)3 requires the document to be registered.
- iv. Include a declaration statement indicating that the constructed or installed features, materials, components or manufactured devices (the installation) identified on the 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.
- v. Be signed by the documentation author to certify the documentation is accurate and complete. When document registration is required by 10-103(a)3, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
- vi. Be signed by the responsible person eligible under Division 3 of the Business and Professions Code to accept responsibility for construction or installation in the applicable classification for the scope of work specified on the Certificate of Installation document(s), or shall be signed by their authorized representative. When document registration is required by 10-103(a)3, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.

~~For newly constructed low-rise residential buildings demonstrating compliance under the Section 151(e)2 multiple orientation alternative for which compliance requires HERS field verification, the person(s) responsible for the installation(s) that requires HERS field verification, or their authorized representative(s), shall submit the applicable sections of the Installation Certificate(s) for retention to a HERS provider data registry in accordance with procedures specified in Reference Residential Appendix RA2. Submittals to the HERS provider data registry shall be made electronically.~~

B. Beginning on October 1, 2010, for all low-rise residential buildings for which compliance requires HERS field verification, the person(s) responsible for the Certificate(s) of Installation installation(s) that requires HERS field verification, or their authorized representative(s), shall submit the applicable sections of the Installation all Certificate of Installation documentation that is applicable to the building(s) for retention to a HERS provider data registry for registration and retention in accordance with procedures specified in Reference Residential Appendix RA2. The submittals Submittals to the HERS provider data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Installation documents that are registered and retained by a HERS provider data registry shall also be automatically transmitted by the data registry, to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

C. For alterations to existing residential buildings for which HERS field verification is not required such as water heater and window replacements, and for additions to existing residential buildings that are less than 300 square feet for which HERS field verification is not required, the enforcement agencies may at their discretion not require any Certificate of Installation documentation, or may develop simplified Certificate of Installation documentation for demonstrating compliance with the Standards.

Exemptions from submitting compliance documentation shall not be deemed to grant authorization for any work to be done in any manner in violation of this code or other provisions of law.

D. Beginning on January 1, 2015, contingent upon approval of data registry(s) by the Commission, for all nonresidential buildings, high-rise residential buildings, and hotels and motels, when designated to allow use of an occupancy group or type regulated by Part 6, the person(s) responsible for the Certificate(s) of Installation shall submit the Certificate(s) for registration and retention to a HERS provider data registry, or a data registry approved by the Commission. The submittals to the HERS provider data registry or approved data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Installation documents that are registered and retained by a HERS provider data registry or approved data registry shall also be automatically transmitted by the data registry, to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

E. For all buildings, a copy of the ~~Installation~~ Certificate(s) of Installation shall be posted, or made available with the building permit(s) issued for the building, and shall be made available to the enforcement agency for all applicable inspections. ~~For installations that require HERS field verification~~ When document registration is required by 10-103(a)3, registered copies of the Certificate(s) of Installation from a HERS provider data registry or a data registry approved by the Commission of the applicable sections of the ~~Installation Certificate(s)~~ shall be posted or made available with the building permit(s) issued for the building, and shall be made available to the enforcement agency for all applicable inspections. If construction on any portion of the building subject to Part 6 will be impossible to inspect because of subsequent construction, the enforcement agency may require the ~~Installation~~ Certificate(s) of Installation to be posted upon completion of that portion. A copy of the ~~Installation~~ Certificate(s) of Installation as specified in this section shall be included with the documentation the builder provides to the building owner at occupancy as specified in Section 10-103(b).

These certificates shall:

- i. ~~Identify the features, materials, components or manufactured devices required to verify compliance with the Appliance Efficiency Regulations and Part 6.~~
- ii. ~~State the number of the building permit under which the construction or installation was performed. Sections of the certificate(s), for which submittal to a HERS provider data registry is required, shall display the unique registration number assigned by the HERS provider data registry.~~
- iii. ~~Include a certification statement indicating that the installed features, materials, components or manufactured devices conform to the Appliance Efficiency Regulations and Part 6 and the requirements for 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.~~
- iv. ~~Be signed by the individual eligible under Division 3 of the Business and Professions Code to accept responsibility for construction, or by their authorized representative. If more than one person has responsibility for building construction, each person shall prepare and sign the part of the document applicable to the portion of construction for which they are responsible; alternatively, the person with chief responsibility for construction shall prepare and sign the document for the entire construction. The signatures shall be original signatures on paper documents or electronic signatures on electronic documents in accordance with applicable requirements specified in Section 10-103(a)3A, Reference Residential Appendix RA2, and Reference Nonresidential Appendix NA1.~~

B4. Certificate of Acceptance. For all ~~new~~ nonresidential buildings, high-rise residential buildings, and hotels and motels, when designated to allow use of an occupancy group or type regulated by Part 6, the ~~applicant person in charge of the acceptance testing, who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the applicable scope of construction or installation of features, materials, components, or manufactured devices regulated by Part 6 or the Appliance Efficiency Regulations (responsible person)~~, shall sign and submit a all applicable Certificate(s) of Acceptance to the enforcement agency documentation in accordance with section 10-103(a)4 and Appendix NA7 to certify conformance with Part 6 prior to receiving a

final occupancy permit. If more than one person has responsibility for the acceptance testing, each person shall sign and submit the Certificate of Acceptance documentation applicable to the portion of the construction or installation for which they are responsible; alternatively, the person with chief responsibility for construction or installation shall sign and submit the Certificate of Acceptance documentation for the entire construction or installation scope of work for the project. Subject to the requirements of Section 10-103(a)4, persons who prepare Certificate of Acceptance documentation (*documentation authors*) shall sign a declaration statement on the documents they prepare to certify the information provided on the documentation is accurate and complete. Persons who perform acceptance test procedures in accordance with the specifications in Reference Joint Appendix NA7, and report the results of the acceptance tests on the Certificate of Acceptance (*field technicians*) shall sign a declaration statement on the documents they submit to certify the information provided on the documentation is true and correct. In accordance with applicable requirements of 10-103(a)4, the signatures provided by *responsible persons, field technicians, and documentation authors* shall be original signatures on paper documents or electronic signatures on electronic documents conforming to the electronic signature specifications in Reference Joint Appendix JA7.

A. All Certificate of Acceptance documentation shall conform to a format and informational order and content approved by the Energy Commission.

These documents shall:

- i. Identify the features, materials, components, manufactured devices, and system performance diagnostic results required to demonstrate compliance with the acceptance requirements to which the applicant must conform as indicated in the plans and specifications submitted under Section 10-103(a)2, and as specified in Reference Nonresidential Appendix NA7.
- ii. State the number of the building permit under which the construction or installation was performed.
- iii. Display the unique registration number assigned by the data registry if Section 10-103(a)4 requires the document to be registered.
- iv. Include a declaration statement indicating that the features, materials, components or manufactured devices identified on the Certificate of Acceptance conform to the applicable acceptance requirements as indicated in the plans and specifications submitted under Section 10-103(a), and with applicable acceptance requirements and procedures specified in the Reference Nonresidential Appendix NA7, and confirms that Certificate(s) of Installation described in Section 10-103(a)3 has been completed and is posted or made available with the building permit(s) issued for the building.
- v. Be signed by the *documentation author* to certify the documentation is accurate and complete. When document registration is required by 10-103(a)4, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
- vi. Be signed by the *field technician* who performed the acceptance test procedures and reported the results on the Certificate of Acceptance. When document registration is required by 10-103(a)4, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
- vii. Be signed by the *responsible person* in charge of the acceptance testing who is eligible under Division 3 of the Business and Professions Code to accept responsibility for construction or installation in the applicable classification for the scope of work identified on the Certificate of Acceptance, or shall be signed by their authorized representative. When document registration is required by 10-103(a)4, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.

B. Beginning on January 1, 2015, contingent upon approval of data registry(s) by the Commission, for all nonresidential buildings, high-rise residential buildings, and hotels and motels, when designated to allow use of an occupancy group or type regulated by Part 6, the person(s) responsible for the Certificate(s) of Acceptance shall submit the Certificate(s) for registration and retention to a HERS provider data registry, or a data registry approved by the Commission. The submittals to the HERS provider data registry or approved

data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Acceptance documents that are registered and retained by a HERS provider data registry or approved data registry shall also be automatically transmitted by the data registry, to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

- C. A copy of the registered Certificate(s) of Acceptance shall be posted, or made available with the building permit(s) issued for the building, and shall be made available to the enforcement agency for all applicable inspections. If construction on any portion of the building subject to Part 6 will be impossible to inspect because of subsequent construction, the enforcement agency may require the Certificate(s) of Acceptance to be posted upon completion of that portion. A copy of the Certificate(s) of Acceptance shall be included with the documentation the builder provides to the building owner at occupancy as specified in Section 10-103(b).

These certificates shall:

- ~~i. Identify the acceptance requirements to which the applicant must conform as indicated in the plans and specifications submitted under Section 10-103(a), and as specified in the Reference Nonresidential Appendix NA7.~~
 - ~~ii. State the number of the building permit under which the construction or installation was performed.~~
 - ~~iii. Include a certification statement indicating that the applicant has demonstrated compliance with the acceptance requirements as indicated in the plans and specifications submitted under Section 10-103(a) and in accordance with applicable acceptance requirements and procedures specified in the Reference Nonresidential Appendix NA7, and confirms that Installation Certificate(s) described in Section 10-103(a)3A are posted, or made available with the building permit(s) issued for the building.~~
 - ~~iv. Be signed by the individual eligible under Division 3 of the Business and Professions Code to accept responsibility for construction, or by their authorized representative. If more than one person has responsibility for building construction, each person shall prepare and sign the part of the document applicable to the portion of construction for which they are responsible; alternatively, the person with chief responsibility for construction shall prepare and sign the document for the entire construction.~~
4. **Insulation Certificate.** After installing wall, ceiling, or floor insulation, the installer shall make available to the enforcement agency or post in a conspicuous location in the building a certificate signed by the installer stating that the installation is consistent with the plans and specifications described in Section 10-103(a)2 and for which the building permit was issued and conforms with the requirements of Part 6. The certificate shall also state the manufacturer's name and material identification, the installed R-value, and (in applications of loose fill insulation) the minimum installed weight per square foot consistent with the manufacturer's labeled installed design density for the desired R-value.
5. **Certificate of Field Verification and Diagnostic Testing (Certificate of Verification).** For all buildings for which compliance requires HERS field verification, a certified HERS rater shall conduct all required HERS field verification and diagnostic testing in accordance with applicable procedures specified in Reference Appendices RA2, RA3, NA1, and NA2. All applicable Certificates of Field-Verification and Diagnostic Testing documentation shall be completed, signed, and dated-submitted by the certified HERS Rater who performed the field verification and diagnostic testing services (responsible person) in accordance with the requirements of Section 10-103(a)5, Reference Appendices RA2, and NA1, by the certified HERS rater who performed the field verification and diagnostic testing services to certify conformance with Part 6. If more than one rater has responsibility for the HERS verification for the building, each rater shall sign and submit the Certificate of Verification documentation applicable to the portion of the building for which they are responsible. Subject to the requirements of Section 10-103(a)5, persons who prepare Certificate of Verification documentation (documentation authors) shall sign a declaration statement on the documents they prepare to certify the information provided on the documentation is accurate and complete. The signatures provided by responsible persons and documentation authors shall be electronic signatures on electronic documents.

A. All Certificate of Verification documentation shall conform to a format and informational order and content approved by the Energy Commission.

These documents shall:

- i. Identify the installed features, materials, components, manufactured devices, or system performance diagnostic results that require HERS verification for compliance with Part 6 as specified on the Certificate(s) of Compliance for the building.
- ii. State the number of the building permit under which the construction or installation was performed.
- iii. Display the unique registration number assigned by the HERS provider data registry, and provide any additional information required by Reference Appendices RA2, RA3, NA1, and NA2.
- iv. Include a declaration statement indicating that the installed features, materials, components or manufactured devices requiring HERS verification conform to the applicable requirements in Reference Appendices RA2, RA3, NA1, NA2, and the requirements specified on the Certificate(s) of Compliance approved by the local enforcement agency, and confirms the same features, materials, components or manufactured devices are identified on the applicable Certificate(s) of Installation signed and submitted by the person(s) responsible for the construction or installation as described in Section 10-103(a)3.
- v. Be signed by the documentation author to certify the documentation is accurate and complete. The signatures shall be electronic signatures on electronic documents in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
- vi. Be signed by the HERS Rater who performed the field verification and diagnostic testing services (responsible person). The signatures shall be electronic signatures on electronic documents in accordance with the electronic signature specifications in Reference Joint Appendix JA7.

B. For all buildings for which compliance requires HERS field verification, the certified HERS rater responsible for the ~~The~~ Certificate(s) of ~~Field Verification and Diagnostic Testing~~ shall ~~be submitted~~ submit the ~~Certificates~~ for registration and retention to a HERS provider data registry in accordance ~~with~~ with the applicable procedures in Reference ~~Residential Appendix~~ Appendices RA2 and ~~Reference Nonresidential Appendix~~ NA1. ~~Submittals~~ The submittals to the HERS provider data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Verification documents that are registered and retained by a HERS provider data registry shall also be automatically transmitted by the data registry, to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

C. For all buildings, a ~~A~~ copy of the registered Certificate(s) of ~~Field Verification and Diagnostic Testing~~ shall be posted, or made available with the building permit(s) issued for the building, and shall be made available to the enforcement agency for all applicable inspections. If construction on any portion of the building subject to Part 6 will be impossible to inspect because of subsequent construction, the enforcement agency may require the Certificate(s) of ~~Field Verification and Diagnostic Testing~~ to be posted upon completion of that portion. A copy of the registered Certificate(s) of ~~Field Verification and Diagnostic Testing~~ shall be included with the documentation the builder provides to the building owner at occupancy as specified in Section 10-103(b).

These certificates shall:

- i. ~~Identify the installed features, materials, components or manufactured devices that require HERS verification for compliance with the Appliance Efficiency Regulations and Part 6 as specified on the Certificate of Compliance for the building.~~
- ii. ~~State the number of the building permit under which the construction or installation was performed, display the unique registration number assigned by the HERS provider data registry, and provide any additional information required by Reference Appendices RA2, RA3, NA1, or NA2.~~

- iii. ~~Include a certification statement indicating that the installed feature(s), material(s), component(s) or manufactured device(s) requiring HERS verification complies with the applicable HERS verification requirements in Reference Appendices RA2, RA3, NA1, NA2, and also conforms to the requirements specified on the Certificate(s) of Compliance approved by the local enforcement agency, and confirms that the same feature(s), material(s), component(s) or manufactured device(s) is identified on the applicable sections of the registered Installation Certificate(s), signed and submitted by the person(s) responsible for the installation as described in Section 10-103(a)3A.~~
- iv. ~~Be signed and dated by the HERS rater who performed the field verification and diagnostic testing services. The signatures shall be electronic signatures on electronic documents.~~

EXCEPTION to Section 10-103(a): Enforcing agencies may exempt nonresidential buildings that have no more than 1,000 square feet of conditioned floor area in the entire building and an occupant load of 49 persons or less from the documentation requirements of Section 10-103(a), provided a statement of compliance with Part 6 is submitted and signed by a licensed engineer or the licensed architect with chief responsibility for the design.

(b) Compliance, Operating, Maintenance, and Ventilation Information to be provided by Builder.

1. Compliance information.

- A. For low-rise residential buildings, at final inspection, the enforcement agency shall require the builder to leave in the building copies of the applicable completed, signed, and dated-submitted compliance documents for the building owner at occupancy. For low-rise residential buildings, such information shall, at a minimum, include ~~information indicated on forms~~ copies of all Certificate of Compliance ~~(CF-1R), Certificate of Installation Certificate (CF-6R), and for buildings for which compliance requires HERS field verification, Certificate(s) of Field Verification and Diagnostic Testing documentation submitted (CF-4R).~~ These ~~forms~~ documents shall be in paper or electronic format and shall conform to the applicable requirements of Section 10-103(a).
- B. For nonresidential buildings, high-rise residential buildings and hotels and motels, at final inspection, the enforcement agency shall require the builder to leave in the building copies of the applicable completed, signed, and dated-submitted compliance documents for the building owner at occupancy. For nonresidential buildings, high-rise residential buildings and hotels and motels, such information shall include copies of all Certificate of Compliance, Certificate of Installation, Certificate of Acceptance and Certificate of Verification documentation submitted ~~ENV, MECH, LTG, and OLTG compliance and acceptance forms.~~ These ~~forms~~ documents shall be in paper or electronic format and shall conform to the applicable requirements of Section 10-103(a).

- 2. Operating information.** At final inspection, the enforcement agency shall require the builder to leave in the building, for the building owner at occupancy, operating information for all applicable features, materials, components, and mechanical devices installed in the building. Operating information shall include instructions on how to operate the features, materials, components, and mechanical devices correctly and efficiently. The instructions shall be consistent with specifications set forth by the Executive Director. For low-rise residential buildings, such information shall be contained in a folder or manual which provides all information specified in Section 10-103(b). This operating information shall be in paper or electronic format.

For dwelling units, buildings or tenant spaces that are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating the feature, material, component or mechanical device installed in the building. This operating information shall be in paper or electronic format.

- 3. Maintenance information.** At final inspection, the enforcement agency shall require the builder to leave in the building, for the building owner at occupancy, maintenance information for all features, materials, components, and manufactured devices that require routine maintenance for efficient operation. Required routine maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label may be limited to identifying, by title and/or publication number, the operation and maintenance manual for that particular model and type of feature, material, component or manufactured device.

For dwelling units, buildings or tenant spaces that are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for maintaining the feature, material, component or mechanical device installed in the building. This information shall be in paper or electronic format.

4. **Ventilation information.**

For low-rise residential buildings, the enforcement agency shall require the builder to leave in the building, for the building owner at occupancy, a description of the quantities of outdoor air that the ventilation system(s) are designed to provide to the building's conditioned space, and instructions for proper operation and maintenance of the ventilation system. For buildings or tenant spaces that are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating and maintaining the feature, material, component or mechanical ventilation device installed in the building. This information shall be in paper or electronic format.

For nonresidential buildings, high-rise residential buildings and hotels and motels, the enforcement agency shall require the builder to provide the building owner at occupancy a description of the quantities of outdoor and recirculated air that the ventilation systems are designed to provide to each area. For buildings or tenant spaces that are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating and maintaining the feature, material, component or mechanical device installed in the building. This information shall be in paper or electronic format.

(c) **Equipment Information to be Provided by Manufacturer or Supplier.** The manufacturer or supplier of any manufactured device shall, upon request, provide to building designers and installers information about the device. The information shall include the efficiency (and other characteristics regulated by Part 6). This information shall be in paper or electronic format.

(d) **Enforcement Agency Requirements.**

1. **Permits.** An enforcement agency shall not issue a building permit for any construction unless the enforcement agency determines in writing that the construction is designed to comply with the requirements of Part 6 that are in effect on the date the building permit was applied for. The enforcement agency determination shall confirm that the documentation requirements of Sections 10-103(a)1 and 10-103(a)2 have been met.

If a building permit has been previously issued, there has been no construction under the permit, and the permit has expired, the enforcement agency shall not issue a new permit unless the enforcement agency determines in writing that the construction is designed to comply with the requirements of Part 6 in effect on the date the new permit is applied for. The enforcement agency determination shall confirm that the documentation requirements of Sections 10-103(a)1 and 10-103(a)2 have been met.

“Determines in writing” includes, but is not limited to, approval of a building permit with a stamp normally used by the enforcement agency.

2. **Inspection.** The enforcement agency shall inspect newly constructed buildings and additions, and alterations to existing buildings ~~new construction~~ to determine whether ~~it the construction or installation~~ is consistent with the agency's approved plans and specifications, and complies with Part 6. Final certificate of occupancy shall not be issued until such consistency and compliance is verified. For Occupancy Group R-3, final inspection shall not be complete until such consistency and compliance is verified.

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 ~~Installation~~-Certificate(s) of Installation, Certificate(s) of Acceptance and Certificate(s) of ~~Field Verification~~ and Diagnostic Testing, 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 ~~Installation~~-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 ~~Installation~~-Certificates of Installation conform to the specifications of Section 10-103(a)3A.

- 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)~~43B~~.
- D. All required Certificates of ~~Field-Verification and Diagnostic Testing~~ 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 ~~Field-Verification and Diagnostic Testing~~ 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.

SECTION 10-104 – EXCEPTIONAL DESIGNS

NOTE: See Section 10-109 for approval of calculation methods and Alternative Component Packages.

- (a) **Requirements.** If a building permit applicant proposes to use a performance compliance approach, and the building designs cannot be adequately modeled by an approved calculation method, an applicant shall be granted a building permit if the Commission finds:
 - 1. That the design cannot be adequately modeled with an approved calculation method;
 - 2. Using an alternative evaluation technique, that the design complies with Part 6; and
 - 3. That the enforcement agency has determined that the design complies with all other legal requirements.
- (b) **Applications.** The applicant shall submit four copies of a signed application with the following materials to the Executive Director:
 - 1. A copy of the plans and specifications required by Section 10-103(a)2A;
 - 2. A statement explaining why meeting the energy budget cannot be demonstrated using an approved calculation method;
 - 3. Documentation from the enforcement agency stating that:
 - A. Meeting the energy budget requirements cannot be demonstrated using an approved calculation method; and
 - B. The design complies with all other legal requirements; and
 - 4. A detailed evaluation of the energy consumption of the proposed building and the building's materials, components, and manufactured devices proposed to be installed to meet the requirements of Part 6, using an alternative evaluation technique. The evaluation shall include a copy of the technique, instructions for its use, a list of all input data, and all other information required to replicate the results.

NOTE: Authority cited: Sections 25402 and 25402.1, Public Resources Code. Reference: Sections 25402 and 25402.1, Public Resources Code.

SECTION 10-105 – ENFORCEMENT BY THE COMMISSION

- (a) **Where there is No Local Enforcement Agency.** Before new construction may begin in an area where there is no local enforcement agency, the Executive Director shall determine in writing that the building design conforms to the requirements of Part 6. The person proposing to construct the building shall submit the information described in Sections 10-103(a)2 and 10-103(a)3 to the Executive Director when such a determination is sought.

- (b) **Where building construction is under the jurisdiction of a state agency.** Pursuant to Public Resources Code Section 25402.1(g)(5), no construction of any state building shall commence until the Department of General Services or the state agency that otherwise has jurisdiction over the property determines that the construction is designed to comply with the requirements of Part 6 and confirms that the documentation requirements of Section 10-103(a)1 have been met, and that the plans indicate the features and performance specifications needed to comply with Part 6. The responsible state agency shall notify the Commission's Executive Director of its determination.
- (c) **Where the Enforcement Agency Fails to Enforce.** If an enforcement agency fails to enforce the requirements of this article or of Part 6, the Commission, after furnishing 10 days written notice, may condition building permit issuance on submission of the information described in Sections 10-103(a)2 and 10-103(a)3 to the Executive Director and on his or her written determination that proposed construction conforms to the requirements of Part 6.

NOTE: Authority cited: Section 25402.1, Public Resources Code. Reference: Section 25402.1, Public Resources Code.

SECTION 10-106 – LOCALLY ADOPTED ENERGY STANDARDS

- (a) **Requirements.** Local governmental agencies may adopt and enforce energy standards for newly constructed buildings, additions, alterations, and repairs to existing buildings- or any other action for which a building permit is issued provided the Energy Commission finds that the standards will require buildings to be designed to consume no more energy than permitted by Title 24, Part 6. ~~Such local standards include, but are not limited to, adopting the requirements of Part 6 before their effective date, requiring additional energy conservation measures, or setting more stringent energy budgets. Local adoption of the requirements of Part 6 before their effective date is a sufficient showing that the local standards meet the requirements of this section and Section 25402.1(f)(2) of the Public Resources Code; in such a case only the documentation listed in Section 10-106(b), and a statement that the standards are those in Part 6, need be submitted.;~~
- (b) **Documentation Application.** Local governmental agencies wishing to enforce locally adopted energy ~~conservation~~ standards shall submit ~~four copies of~~ an application with the following materials to the Executive Director:
1. The proposed ~~local~~ energy standards.
 2. The local governmental agency's findings and A study with supporting analysis on showing how the local governmental agency determined the energy savings and cost effectiveness of the proposed energy standards.
 3. ~~A statement finding by the local governmental agency that the local energy standards will require buildings to be designed to consume no more energy than permitted by Part 6.~~
 4. ~~The local governmental agency adoption (conditional, if necessary), with appropriate findings, of the proposed local energy standards and the supporting cost effectiveness study.~~
 4. ~~The basis of the agency's determination that the standards are cost effective.~~
 3. Any findings, determinations, declarations or reports, including any negative declaration or environmental impact report, required pursuant to the California Environmental Quality Act, Pub. Resources Code section 21000 et seq.

NOTE: Authority cited: Section 25402.1, Public Resources Code. Reference: Sections 25402.1, 21080.4, 21153, Public Resources Code.

SECTION 10-107 – INTERPRETATIONS

- (a) The Commission may make a written determination as to the applicability or interpretation of any provision of this article or of Part 6, upon written application, if a dispute concerning a provision arises between an applicant for a building permit and the enforcement agency, and the dispute has been heard by the local board of permit appeals or other highest local review body. Notice of any such appeal, including a summary of the dispute and the section of the

regulations involved, shall if possible be sent to the Commission by the enforcing agency 15 days before the appeal is heard, and the result of the appeal shall be sent to the Commission within 15 days after the decision is made. Either party to the dispute may apply for a determination but shall concurrently deliver a copy of the application to the other party. The determinations are binding on the parties.

- (b) The Executive Director may, upon request, give written advice concerning the meaning of any provision of this article or of Part 6. Such advice is not binding on any person.
- (c) In addition to the procedures and protocols identified in the Alternative Calculation Method Approval Manuals and the Reference Appendices, the Executive Director may authorize alternative procedures or protocols that demonstrate compliance with Part 6.

NOTE: Authority cited: Section 25402.1, Public Resources Code. Reference: Section 25402.1, Public Resources Code.

SECTION 10-108 – EXEMPTION

- (a) **Requirements.** The Commission may exempt any building from any provision of Part 6 if it finds that:
1. Substantial funds had been expended in good faith on planning, designing, architecture, or engineering of the building before the adoption date of the provision.
 2. Compliance with the requirements of the provision would be impossible without both substantial delays and substantial increases in costs of construction above the reasonable costs of the measures required to comply with the provision.
- (b) **Application.** The applicant shall submit four copies of a signed application with the following materials to the Executive Director:
1. A summary of the claimant's contracts for the project;
 2. A summary of internal financial reports on the project;
 3. Dated schedules of design activities; and
 4. A progress report on project completion.

NOTE: Authority cited: Section 25402.1, Public Resources Code. Reference: Section 25402.1, Public Resources Code.

SECTION 10-109 – COMPLIANCE SOFTWARE, CALCULATION METHODS AND ALTERNATIVE COMPONENT PACKAGES, EXCEPTIONAL METHODS, DATA REGISTRIES AND RELATED INPUT SOFTWARE, AND ELECTRONIC DOCUMENT REPOSITORIES

NOTE: See Section 10-104 for approval of exceptional designs.

(a) Compliance software, alternative component packages, exceptional methods, data registries and related input software, or electronic document repositories must be approved by the Commission in order to be used to demonstrate compliance with Part 6.

(b) APPLICATION

Applications for approval of compliance software, alternative component packages, or exceptional methods must be made as follows:

1. An applicant shall submit four copies of a signed application form specified by the Executive Director.

2. The application shall include the following materials:

- ~~i1. A description of the functional and analytical capabilities and limitations with respect to the occupancies, designs, materials, and devices, processes, and procedures covered by Part 6 of the compliance software, alternative component package, calculation method, or exceptional method;~~
- ~~ii2. A demonstration that the criteria in Section 10-109 are met, and;~~
- ~~iii3.~~
- ~~iv4. An initial fee of two thousand dollars (\$2,000). The total fee shall cover the Commission's cost of reviewing and analyzing the application. Within 75 days of receipt of an application, the Commission will provide an estimate of the total maximum cost to review and analyze the application. After the Commission determines the total costs, if the costs exceeds the initial fee, the Commission shall assess an additional fees to cover the total ose costs. If the actual cost is less than the initial, or any estimated maximum, fee, the Commission shall refund the difference to the applicant.~~

(c) COMPLIANCE SOFTWARE

~~(a1) Public Domain Computer Programs.~~ In addition to the ~~present approved~~ public domain computer programs ~~that are approved pursuant to Public Resources Code section 25402.1~~, the Commission may, upon written application or its own motion, approve additional public domain computer programs that may be used to demonstrate that proposed building designs meet energy budgets.

~~1A.~~ The Commission shall ensure that users' manuals or guides for each approved program are available.

~~2B.~~ The Commission shall approve a program only if, ~~when it models building designs or features~~, it predicts energy consumption substantially equivalent to that predicted by the ~~above-referenced~~ public domain computer program, ~~when it models building designs or features~~.

~~(b2) Alternative Calculation Methods (All Occupancies).~~ ~~In addition to~~ ~~The Commission may approve Nnon-~~ public domain computer programs ~~as an alternative calculation method~~, ~~the approved by the Commission may approve alternative calculation methods (ACMs)~~ that ~~building permit~~ applicants ~~for building permits~~ may then use to demonstrate compliance with the performance standards (energy budgets) in Part 6.

~~1A. General requirements.~~ ~~In addition to the application requirements of subdivision (b) above, an application for approval of To obtain approval for a compliance software must include documentation demonstrating, the proponent shall submit an application that demonstrates, that the compliance software meets the requirements, specifications, and criteria set forth in the Residential or Nonresidential ACM Approval Manual, as appropriate.:~~

~~Ai.~~ Makes no changes in any input parameter values specified by the Commission in Item 2 below;

~~Bii.~~ Provides input and output documentation that facilitates the enforcement agency's review and meets the formatting and content criteria found in the Residential or Nonresidential ACM Manual;

~~Ciii.~~ Is supported by clear and concise instructions for using the method to demonstrate that the energy budget requirements of Part 6 are met; and

~~Div.~~ Is reliable and accurate relative to the appropriate public domain computer program;

~~2B. Procedural requirements for alternative calculation methods.~~ In order to obtain approval of a compliance software, the applicant must comply with the requirements, specifications, and criteria set forth in the Residential or Nonresidential ACM Manual. The ACM Manuals specify application requirements, minimum modeling capabilities, required output forms and instructions, input assumptions, testing requirements, test approval criteria, vendor requirements, and other related requirements. The requirements, specifications, and criteria in the 2008 Residential or Nonresidential ACM Manuals are hereby incorporated by reference.

NOTE: Copies of the ACM Approval Manuals may be obtained from the Commission's website at: www.energy.ca.gov/title24.

~~3. Application.~~ The applicant shall submit four copies of a signed application form specified by the Executive Director. ~~The application shall include the following materials:~~

- A. ~~The method's analytical capabilities and limitations with respect to the occupancies, designs, materials, and devices covered by Part 6;~~
- B. ~~A demonstration that the criteria in Section 10-109(b) are met;~~
- C. ~~Each of the items on the "Application Checklist" in the Residential or Nonresidential ACM Manual; and~~
- D. ~~An initial fee of two thousand dollars (\$2000). The total fee shall cover the Commission's cost of reviewing and analyzing the proposed method. After the Commission determines the total costs, if the costs exceed the initial fee, the Commission shall assess additional fees to cover those costs; if the costs are less than the initial fee, the Commission shall refund the difference to the applicant.~~

~~4. **Exceptional methods.** If the alternative calculation method analyzes designs, materials, or devices that cannot be adequately modeled using the public domain computer programs, the method may be approved as an exceptional method. Applications for approval of exceptional methods shall include theoretical and empirical information that verify the method's accuracy, and shall also include the other documentation and fees required by Section 10-109(b).~~

~~5. **Approval.** The Commission may approve a method unconditionally, may restrict approval to specified occupancies, designs, materials, or devices, or may reject the application.~~

~~6. **Resubmittal.** An applicant may resubmit a rejected method or may request modification of a restricted approval. Such application shall include the information specified in Section 10-109(b) and shall indicate how the method has been changed to enhance its accuracy or capabilities.~~

~~7. **Modification.** Whenever an approved calculation method is changed in any way, the method shall be resubmitted under this section for reapproval. The Executive Director may waive any of the requirements of this paragraph for nonsubstantive changes.~~

~~(e) The Commission may modify or withdraw certification of a program or method under Sections 10-109(a) or 10-109(b) based on approval of other programs or methods that are more suitable.~~

(d) ALTERNATIVE COMPONENT PACKAGES

~~(d) **Alternative Component Packages.** In addition to the application requirements of subdivision (b) above, an application for approval of an The Commission may approve any alternative component package must include documentation that demonstrates that the package:~~

~~i. in addition to the packages in Sections 143(a) and 151(f) of Part 6, which it determines will meet the applicable energy budgets, and~~

~~ii. is likely to apply to a significant percentage of newly constructed buildings or to a significant segment of the building construction and design community. Applications for approval of packages shall use application forms specified by the Executive Director and shall be subject to the same fee requirements set forth in subsection (b).~~

~~(e) **Publication of Commission Determinations.** The Executive Director shall annually publish a manual, newsletter, or other administrative guide containing determinations made by the Commission pursuant to this section on or before December 31 of the calendar year.~~

(e) EXCEPTIONAL METHODS.

~~The Commission may approve an exceptional method that analyzes a design, material, or device that cannot be adequately modeled using the public domain computer programs. Applications for approval of exceptional methods shall include all information need to verify the method's accuracy. Applications for approval of exceptional methods shall use application forms specified by the Executive Director and shall be subject to the same fee requirements set forth in subsection (b).~~

~~(f) **Commission Action**COMMISSION ACTION. The Commission may take the following actions on an application submitted pursuant to this section:~~

1. approve the application unconditionally.
2. restrict approval to specified occupancies, designs, materials, or devices, or
3. reject the application.

(g) ~~Resubmittal~~RESUBMITTAL. An applicant may resubmit a rejected application or may request modification of a restricted approval. Such application shall include the information required pursuant to this section, and, if applicable, shall indicate how the proposed compliance software, alternative component package, or exceptional method has been changed to enhance its accuracy or capabilities, if applicable.

3. Modification. Whenever an approved compliance software, alternative component package, or exceptional method is changed in any way, it must be resubmitted under this section for approval.
4. The Commission may modify or withdraw approval of compliance software, an alternative component package, or an exceptional method based on its approval of other programs, methods or registries that are more suitable.

(h) In addition to the procedures and protocols identified in the Alternative Calculation Method Approval Manuals and the Reference Appendices, the Executive Director may authorize alternative procedures or protocols that demonstrate compliance with Part 6.

(i) DATA REGISTRIES AND ELECTRONIC DOCUMENT REPOSITORIES

1. Data Registries and Related Data Input Software.

Data registries and related data input software shall conform to the requirements specified in Reference Joint Appendix JA7.

- A. The Commission may approve residential data registries that provide for registration, when required by Part 6, of all residential compliance documentation and the nonresidential Certificate of Verification.
- B. The Commission may approve nonresidential data registries that provide for registration, when required by Part 6, of all nonresidential compliance documentation. However, nonresidential data registries may not provide for registration of nonresidential Certificates of Verification.
- C. The Commission may approve software used for data input to various data registries for registering, when required by Part 6, residential or nonresidential compliance documentation.

2. Electronic Document Repositories.

- A. The Executive Director may approve electronic document repositories that retain for the Commission electronic compliance documentation generated by residential and nonresidential data registries when registration is required by Part 6.

NOTE: Authority cited: Section 25402.1, Public Resources Code. Reference: Section 25402.1, Public Resources Code.

SECTION 10-110 – PROCEDURES FOR CONSIDERATION OF APPLICATIONS UNDER SECTIONS 10-104, 10-106, 10-108, AND 10-109

- (a) Within 60 days of receipt of an application, the Executive Director shall determine if the application is complete with all the supporting information required pursuant to Sections 10-104, 10-106, 10-108, or 10-109 (the complete application package). If the application is complete, the Executive Director shall make the complete application package available to interested parties. Comments from interested parties must be submitted within 60 days after being made available acceptance of the application.

- (b) Within 75 days of ~~the date the application is determined to be complete~~~~receipt of an application~~, the Executive Director may request any additional information needed to evaluate the application. ~~If the additional information is incomplete,~~ ~~Consideration of the application will be delayed until the applicant submits~~ the requested complete additional information.
- (c) Within 75 days of receipt of the date the application is determined to be complete, the Executive Director may convene a workshop to gather additional information from the applicant and other interested parties. Interested parties will have 15 days after the workshop to submit additional information regarding the application.
- (d) Within 90 days ~~the date the application is determined to be complete~~~~after the Executive Director receives the application~~, or within 30 days after receipt of complete additional information requested under Section 10-110(b), or within 60 days after the receipt of additional information submitted by interested parties under Section 10-110(c), whichever is later, the Executive Director shall submit to the Commission a written recommendation on the application.
- (e) The complete application package, any additional information considered by the Executive Director, and the Executive Director's recommendation shall be placed on the consent calendar and considered at the next business meeting after submission of the recommendation. The matter may be removed from the consent calendar at the request of any person.
- (f) The Executive Director may charge a fee to recover the costs of processing and reviewing applications, with the exception of Section 10-106 applications.
- (g) All applicants have the burden of proof to establish that their applications should be granted.

NOTE: Authority cited: Section 25402.1, Public Resources Code. Reference: Section 25402.1, Public Resources Code.

SECTION 10-111 – CERTIFICATION AND LABELING OF FENESTRATION PRODUCT

U-FACTORS, SOLAR HEAT GAIN COEFFICIENTS AND AIR LEAKAGE

This section establishes rules for implementing labeling and certification requirements relating to U-factors, solar heat gain coefficients (SHGCs), visible transmittance (VT) and air leakage for fenestration products under Section 110.6(a) of ~~Title 24, California Code of Regulations~~, Part 6. This section also provides for designation of the National Fenestration Rating Council (NFRC) as the supervisory entity responsible for administering the state's certification program for fenestration products, provided NFRC meets specified criteria.

(a) **Labeling Requirements.**

1. **Temporary labels.**

A. Every manufactured ~~and site-built~~ fenestration product shall have attached to it a clearly visible temporary label that lists ~~or have an associated label certificate~~ the U-factor, the solar heat gain coefficient (SHGC) and Visible Transmittance (VT) of that product and the method used to derive those values, and for manufactured fenestration products certifies and that certifies compliance with the air leakage requirements of Section 110.6(a)1.- For the Component Modeling Approach (CMA) and site-built fenestration products shall have an associated label certificate that lists the U-factor, the Solar Heat Gain Coefficient (SHGC), and the Visible Transmittance (VT).

B. U-factor, SHGC and VT shall be determined by either:

- A. Fenestration products rated and certified using NFRC 100, NFRC 200, NFRC 202 or NFRC 400 Rating Procedures. The manufacturer shall stipulate that the ratings were determined in accordance with applicable NFRC procedures. For manufactured fenestration products, a temporary label certificate approved by the supervisory entity meets the requirements of this section. For component modeling and site-built fenestration

products, a label certificate approved by the supervisory entity (NFRC) meets the requirements of this section.

- B. ~~Fenestration products rated using a default value approved by the Commission.~~ For manufactured or site-built fenestration products not rated by NFRC, a temporary label with the words “CEC Default U-factor,” followed by the appropriate default U-factor specified in Section 110.6(a)2 and with the words “CEC Default SHGC,” followed by the appropriate default SHGC specified in Section 110.6(a)3 and with the words "CEC Default VT," followed by the appropriate VT as specified in Section 110.6(a)4, meets the requirements of this Subsection B. For site-built fenestration products, a default label certificate approved by the Commission meets the requirements of this section.
- C. The temporary label shall also certify that the product complies with the air leakage requirements of Section 110.6(a)1 of the Standards-
2. **Permanent labels.** If a product is rated using the NFRC Rating Procedure, it shall have a permanent label that is either a stand-alone label, an extension or tab of an existing permanent certification label being used by the manufacturer/responsible party, or series of marks on the product. The permanent label, coupled with observable product characteristics, can be used to trace the product to certification information on file with the supervisory entity or to a directory of certified products, published by the supervisory entity. For CMA and site-built fenestration products, a label certificate approved by the supervisory entity meets the requirements of this section.

EXCEPTION to Section 10-111(a): Field-fabricated fenestration products.

(b) **Certification Requirements.**

1. **Certification to default ratings.** The manufacturer shall certify on the Default Label that ~~If at the~~ product's U-factor ~~and~~ SHGC ~~and VT meets the default criteria in~~ are default values approved by the Commission as specified in Sections 110.6(a)2, ~~and~~ 110.6(a)3, ~~and~~ 110.6(a)4; and the U-factor and SHGC shall be certified by the manufacturer.
- A. A temporary label, affixed to the product, that meets the requirements of Section 10-111(a)1B meets this requirement.
- B. If the product claims the default U-factor for a thermal-break product, the manufacturer shall also certify on the label that the product meets the thermal-break product criteria, specified on the default table, on which the default value is based. Placing the terms “Meets Thermal-Break Default Criteria” on the default temporary label or default label certificate meets this requirement.
2. **Certification to NFRC rating procedure.** If a product's U-factor, ~~or~~ SHGC or VT is based on the NFRC Rating Procedure, the U-factor, ~~or~~ SHGC or VT shall be certified by the manufacturer according to the procedures of an independent certifying organization approved by the Commission.
- A. A temporary label, affixed to the product or label certificate for CMA and site-built fenestration, meeting the requirements of Section 10-111(a) certified by the independent certifying organization complies with this requirement.
- B. An “independent certifying organization approved by the Commission” means any organization authorized by the supervisory entity to certify U-factor ratings, ~~a~~ and Solar Heat Gain Coefficient and Visual Transmittance ratings in accordance with the NFRC Rating Procedure. If the Commission designates the NFRC as the supervisory entity, any independent certification and inspection agency (IA) licensed by NFRC shall be deemed to be an “independent certifying organization approved by the Commission.”
- C. The “supervisory entity” means the National Fenestration Rating Council (NFRC), except as provided in paragraph (c) 1.

EXCEPTION to Section 10-111(b): Field-fabricated fenestration products.

- (c) **Designation of Supervisory Entity.** The National Fenestration Rating Council shall be the supervisory entity to administer the certification program relating to U-factors, SHGC, and VT ~~and solar heat gain coefficient~~ ratings for fenestration products, provided the Commission determines that the NFRC meets the criteria in paragraph (d).

1. The Commission may consider designating a supervisory entity other than NFRC only if the Commission determines that the NFRC cannot meet the criteria in paragraph (d). Such other supervisory entity shall meet the criteria in paragraph (d) prior to being designated.
2. The Commission shall periodically review, at least annually, the structure and operations of the supervisory entity to ensure continuing compliance with the criteria in paragraph (d).

(d) Criteria for Supervisory Entity.

1. Membership in the entity shall be open on a nondiscriminatory basis to any person or organization that has an interest in uniform thermal performance ratings for fenestration products, including, but not limited to, members of the fenestration industry, glazing infill industry, building industry, design professionals, specifiers, utilities, government agencies, and public interest organizations. The membership shall be composed of a broad cross section of those interested in uniform thermal performance ratings for fenestration products.
2. The governing body of the entity shall reflect a reasonable cross-section of the interests represented by the membership.
3. The entity shall maintain a program of oversight of product manufacturers, laboratories, and independent certifying organizations that ensures uniform application of the NFRC Rating Procedures, labeling and certification, and such other rating procedures for other factors affecting energy performance as the NFRC and the Commission may adopt.
4. The entity shall require manufacturers and independent certifying organizations within its program to use only laboratories accredited by the supervisory entity to perform simulations and tests under the NFRC Rating Procedure or by an NFRC Approved Calculation Entity (ACE) under the Component Modeling Approach (CMA)- Product Certification Program(PCP)..-
5. The entity shall maintain appropriate guidelines for testing and simulation laboratories, manufacturers, and certifying agencies, including requirements for adequate:
 - A. Possession and calibration of equipment;
 - B. Education, competence, and training of personnel;
 - C. Quality control;
 - D. Record keeping and reporting;
 - E. Periodic review (including, but not limited to, blind testing by laboratories; inspections of products; and inspections of laboratories, manufacturing facilities, and certifying agencies);
 - F. Challenges to certified ratings; and
 - G. Guidelines to maintain the integrity of the program, including, but not limited to, provisions to avoid conflicts of interest within the rating and certification process.
6. The entity shall be a nonprofit organization and shall maintain reasonable, nondiscriminatory fee schedules for the services it provides and shall make its fee schedules, the financial information on which fees are based, and financial statements available to its members for inspection.
7. The entity shall provide hearing processes that give laboratories, manufacturers, and certifying agencies a fair review of decisions that adversely affect them.
8. The entity shall maintain a certification policy committee whose procedures are designed to avoid conflicts of interest in deciding appeals, resolving disputes, and setting policy for the certifying organizations in its program.
9. The entity shall publish at least annually a directory of products certified and decertified within its program.
10. The entity itself shall be free from conflict-of-interest ties or to undue influence from any particular fenestration manufacturing interest(s), testing or simulation lab(s), or independent certifying organization(s).

11. The entity shall provide or authorize the use of labels and label certificates for Component Modeling Approach and site-built fenestration products that can be used to meet the requirements of Section 110.6(a)~~2~~, 110.6(a)3 and ~~110.6(a)4~~, and this section.
 12. The entity's certification program shall allow for multiple participants in each aspect of the program to provide for competition between manufacturers, testing labs, simulation labs, and independent certifying organizations.
- (e) **Certification for Other Factors.** Nothing in this section shall preclude any entity, whether associated with a U-factor, ~~and~~ SHGC and VT certification program or not, from providing certification services relating to factor other than U-factors, ~~and~~ SHGCs and VTs for fenestration products.

NOTE: Authority cited: Section 25402.1, Public Resources Code. Reference: Section 25402.1, Public Resources Code.

SECTION 10-112 – CRITERIA FOR DEFAULT TABLES

- (a) The Commission shall maintain tables of default U-factors and SHGCs for use as an alternative to U-factors and SHGCs derived based on the NFRC Rating Procedure. The default values shall meet the following criteria:
1. The values shall be derived from simulations of products using the same computer simulation program(s) used in the NFRC Rating Procedure.
 2. The default values shall be set so that they do not provide to any significant number of products a lower U-factor or SHGC than those products would obtain if they were rated using the full NFRC Rating Procedure.
- (b) The Commission shall periodically review and revise the default tables as necessary to ensure that the criteria are met.

NOTE: Authority cited: Section 25402.1, Public Resources Code.

SECTION 10-113 – CERTIFICATION AND LABELING OF ROOFING PRODUCT REFLECTANCE AND EMITTANCE

This section establishes rules for implementing labeling and certification requirements relating to reflectance and emittance for roofing products for showing compliance with Sections 140.1, 140.2, 140.3(a)1, 140.9(b)1B, 150.1(~~c~~)12, 150.2(b)1H, and 150.2(b)2 of Title 24, California Code of Regulations, Part 6. This section also provides for designation of the Cool Roof Rating Council (CRRC) as the supervisory entity responsible for administering the state's certification program for roofing products, provided CRRC meets specified criteria.

(a) **Labeling Requirements.**

Every roofing product installed in construction to take compliance credit or meet the Prescriptive requirements for reflectance and emittance under Sections 140.1, 140.2, 140.3(a)1, 140.9(b)1B, 150.1(~~c~~)12, 150.2(b)1H or 150.2(b)2 shall have a clearly visible packaging label that lists the emittance and the initial and 3-year aged solar reflectance, or a CRRC approved accelerated aged solar reflectance, tested in accordance with CRRC-1.

Packaging for liquid-applied roof coatings shall state the product meets the requirements specified in Section 110.8(i) 4.

(b) **Certification Requirements.**

Every roofing product installed in construction to take compliance credit or meet the Prescriptive requirements for reflectance and emittance under Sections 140.1, 140.2, 140.3(a)1, 140.9(b)1B, 150.1(~~c~~)12, 150.2(b)1H or 150.2(b)2 shall be certified by CRRC or another supervisory entity approved by the Commission pursuant to Section 10-113(c).

- (c) **Designation of Supervisory Entity.** The Cool Roof Rating Council shall be the supervisory entity to administer the certification program relating to reflectance and emittance ratings for roofing products, provided the Commission determines that the CRRC meets the criteria in Section 10-113(d)paragraph (d).

1. The Commission may consider designating a supervisory entity other than CRRC ~~only~~ if the Commission determines that the CRRC ~~is an~~ is not meeting the criteria in Section 10-113(d) paragraph (d). Such other supervisory entity shall meet the criteria in Section 10-113(d) paragraph (d) prior to being designated.
2. The Commission shall periodically review, at least annually, the structure and operations of the supervisory entity to ensure continuing compliance with the criteria in Section 10-113(d) paragraph (d). The supervisory entity shall provide an annual report to the Commission explaining all of the measures it has taken to comply with the criteria in Section 10-113(d).

(d) Criteria for Supervisory Entity.

1. Membership in the entity shall be open on a nondiscriminatory basis to any person or organization that has an interest in uniform performance ratings for roofing products, including, but not limited to, members of the roofing industry, building industry, design professionals, specifiers, utilities, government agencies, and public interest organizations. The membership shall be composed of a broad cross section of those interested in uniform thermal performance ratings for roofing products.
2. The governing body of the entity shall reflect a reasonable cross-section of the interests represented by the membership.
3. The entity shall maintain a program of oversight of product manufacturers, laboratories, and independent certifying organizations that ensures uniform application of the CRRC testing and rating procedures, labeling and certification, and such other rating procedures for other factors- that improves the accuracy of properties of roofing products affecting energy performance as the CRRC and the Commission may adopt.
4. The entity shall require manufacturers and independent certifying organizations within its program to use only laboratories accredited by the supervisory entity to perform tests under the CRRC rating procedure.
5. The entity shall maintain appropriate guidelines for testing laboratories and manufacturers, including requirements for adequate:
 - A. Possession and calibration of equipment;
 - B. Education, competence, and training of personnel;
 - C. Quality control;
 - D. Record keeping and reporting;
 - E. Periodic review (including but not limited to, blind testing by laboratories; inspections of products; inspections of laboratories, and manufacturing facilities);
 - F. Challenges to certified ratings; and
 - G. Guidelines to maintain the integrity of the program, including, but not limited to, provisions to avoid conflicts of interest within the rating and certification process.
6. The entity shall be a nonprofit organization and shall maintain reasonable, nondiscriminatory fee schedules for the services it provides, and shall make its fee schedules, the financial information on which fees are based, and financial statements available to its members for inspection.
7. The entity shall provide hearing processes that give laboratories, manufacturers and certifying agencies a fair review of decisions that adversely affect them.
8. The entity shall maintain a certification policy committee, whose procedures are designed to avoid conflicts of interest in deciding appeals, resolving disputes and setting policy for the certifying organizations in its program.
9. The entity shall publish at least annually a directory of products certified and decertified within its program.
10. The entity itself shall be free from conflict-of-interest ties or to undue influence from any particular roofing product manufacturing interest(s), testing or independent certifying organization(s).
11. The entity shall provide or authorize the use of labels that can be used to meet the requirements for showing compliance with the requirements of Sections 140.1, 140.2, 140.3(a)1, 140.9(b)1B, 150.1 ~~(f)~~ 12, 150.2(b)1H and 150.2(b)2, and this section.

12. The entity's certification program shall allow for multiple participants in each aspect of the program to provide for competition between manufacturers and between testing labs.

NOTE: Authority cited: Section 25402.1, Public Resources Code. Reference: Section 25402.1, Public Resources Code.

SECTION 10-114 – DETERMINATION OF OUTDOOR LIGHTING ZONES, ~~LOCAL OUTDOOR LIGHTING ORDINANCES,~~ AND ADMINISTRATIVE RULES FOR USE

This section establishes rules for implementing outdoor lighting zones, ~~and rules for adopting specific outdoor light levels,~~ to show compliance with Section 140.7 of Title 24, California Code of Regulations, Part 6.

- (a) **Lighting Zones.** Exterior lighting allowances in California vary by Lighting Zones (LZ).
- (b) **Lighting Zone Characteristics.** TABLE 10-114-A specifies the relative ambient illumination level and the statewide default location for each lighting zone.
- (c) **Amending the Lighting Zone Designation.** A local jurisdiction may officially adopt changes to the lighting zone designation of an area by following a public process that allows for formal public notification, review, and comment about the proposed change. The local jurisdiction may determine areas where Lighting Zone 4 is applicable and may increase or decrease the lighting zones for areas that are in State Default Lighting Zones 1, 2 and 3, as specified in TABLE 10-114-A.
- (d) **Commission Notification, Amended Outdoor Lighting Zone Designation.** Local jurisdictions who adopt changes to the State Default Lighting Zones shall notify the Commission by providing the following materials to the Executive Director:
 1. A detailed specification of the boundaries of the adopted Lighting Zones, consisting of the county name, the city name if any, the zip code(s) of the redesignated areas, and a description of the physical boundaries within each zip code.
 2. A description of the public process that was conducted in adopting the Lighting Zone changes.
 3. An explanation of how the adopted Lighting Zone changes are consistent with the specifications of Section 10-114.

The Commission shall have the authority to not allow Lighting Zone changes which the Commission finds to be inconsistent with the specifications of Section 10-114.

- ~~(e) **Amending Local Outdoor Ordinances.** A local jurisdiction may officially adopt specific outdoor light levels, which shall be expressed as average or minimum footcandle levels, by following a public process that allows for formal public notification, review, and comment about the proposed change.~~
- ~~(f) **Commission Notification, Local Outdoor Lighting Ordinances.** Local jurisdictions who adopt specific outdoor light levels shall notify the Commission by providing the following materials to the Executive Director:
 1. A detailed description of the adopted specific light levels, consisting of the minimum or average light levels adopted, the applications where these light levels apply, and the county name, city name if any, and zip code(s) of all areas covered by the local ordinance.
 2. A description of the public process that was conducted in adopting the specific light levels.~~

TABLE 10-114-A LIGHTING ZONE CHARACTERISTICS AND RULES FOR AMENDMENTS BY LOCAL JURISDICTIONS

Zone	Ambient Illumination	State wide Default Location	Moving Up to Higher Zones	Moving Down to Lower Zones
LZ1	Dark	Government designated parks, recreation areas, and wildlife preserves. Those that are wholly contained within a higher lighting zone may be considered by the local government as part of that lighting zone.	A government designated park, recreation area, wildlife preserve, or portions thereof, can be designated as LZ2 or LZ3 if they are contained within such a zone.	Not applicable.
LZ2	Low	Rural areas, as defined by the 2000 U.S. Census.	Special districts within a default LZ2 zone may be designated as LZ3 or LZ4 by a local jurisdiction. Examples include special commercial districts or areas with special security considerations located within a rural area.	Special districts and government designated parks within a default LZ2 zone maybe designated as LZ1 by the local jurisdiction for lower illumination standards, without any size limits.
LZ3	Medium	Urban areas, as defined by the 2000 U.S. Census.	Special districts within a default LZ3 may be designated as a LZ4 by local jurisdiction for high intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels.	Special districts and government designated parks within a default LZ3 zone may be designated as LZ1 or LZ2 by the local jurisdiction, without any size limits.
LZ4	High	None.	Not applicable.	Not applicable.

EFFICIENCY STANDARDS

CALIFORNIA CODE OF REGULATIONS

TITLE 24, PART 6

100.0 to 100.2 Scope Definitions TDV

SUBCHAPTER 1

ALL OCCUPANCIES—GENERAL PROVISIONS

SECTION ~~100~~100.0 – SCOPE

(a) **Buildings Covered.** The provisions of ~~Title 24, Part 6~~Part 6, apply to all buildings:

1. That are of Occupancy Group A, B, E, F, H, M, R, S, or U; and
2. For which an application for a building permit or renewal of an existing permit is filed (or is required by law to be filed) on or after the effective date of the provisions, or which are constructed by a governmental agency; and
3. That are:
 - A. Unconditioned ~~spaces; or~~
 - ~~B. Indirectly or directly conditioned, by mechanical heating or mechanical cooling, spaces or process spaces; or~~
 - ~~C. Low-rise residential buildings that are heated with a wood heater or another non-mechanical heating system.~~

EXCEPTION 1 to Section ~~100~~100.0(a): Qualified historic buildings, as regulated by the California Historic Building Code (Title 24, Part 8). Lighting in qualified historic buildings shall comply with the applicable requirements in Section 140.6(a)3Q.

EXCEPTION 2 to Section ~~100~~100.0(a): Building departments, at their discretion, may exempt temporary buildings, temporary outdoor lighting or temporary lighting in an unconditioned building, or structures erected in response to a natural disaster. Temporary buildings or structures shall be completely removed upon the expiration of the time limit stated in the permit.

(b) **Parts of Buildings Regulated.** The provisions of ~~Title 24, Part 6~~Part 6, apply to the building envelope, space-conditioning systems, water-heating systems, ~~and~~ indoor lighting systems of buildings, ~~and~~ outdoor lighting systems, and signs located either indoors or outdoors, in buildings that are: (i) covered by Section ~~100~~100.0(a), and (ii) as set forth in TABLE 100.0-A ~~TABLE 100.0~~ ~~TABLE 100.0~~ ~~TABLE 100.0~~ ~~TABLE 100.0~~ ~~A.~~

(c) ~~Floors and Habitable Stories.~~

1.

~~Only habitable floors that have at least 50 percent of their volume above grade as defined in the CBC shall be counted in determining how many habitable stories a building has.~~

~~2.—All conditioned space in a floor-story shall comply with Title 24, Part 6~~Part 6, whether or not the story floor is above grade and whether or not it is habitable. All unconditioned space in a story floor shall comply with the lighting requirements of ~~Title 24, Part 6~~Part 6, whether or not the story floor is above grade and whether or not it is habitable.

(d) **Outdoor Lighting and Indoor and Outdoor Signs.** The provisions of ~~Title 24, Part 6~~Part 6, apply to outdoor lighting systems and to signs located either indoors or outdoors as set forth in TABLE 100.0-A.

(e) **Sections Applicable to Particular Buildings.** ~~TABLE 100.0-A~~ ~~TABLE 100.0~~ ~~TABLE 100.0~~ ~~TABLE 100.0~~ ~~A~~ and this subsection list the provisions of ~~Title 24, Part 6~~Part 6, that are applicable to different types of buildings covered by Section ~~100~~100.0(a).

1. **All buildings.** Sections ~~100~~100.0 through ~~110.9-10~~ apply to all buildings.

EXCEPTION to Section ~~100~~100.0(e)1: Spaces or requirements not listed in TABLE 100.0-A.

2. Newly constructed buildings.

- A. **All newly constructed buildings.** Sections 110.0 through 110.9-10 apply to all newly constructed buildings within the scope of Section ~~100100.0~~(a). In addition, newly constructed buildings shall meet the requirements of B, C, ~~or~~ D or E, as applicable.
- B. **Nonresidential, high-rise residential, and hotel/motel buildings that are mechanically heated or mechanically cooled.**
- i. Sections applicable. Sections 120.0 through 140.8 apply to newly constructed nonresidential buildings, high-rise residential buildings, and hotels/motels that are mechanically heated or mechanically cooled.
 - ii. Compliance approaches. In order to comply with ~~Title 24, Part 6~~ Part 6, newly constructed nonresidential buildings, high-rise residential buildings, and hotels/motels that are mechanically heated or mechanically cooled must meet the requirements of:
 - a. Mandatory measures: The applicable provisions of Sections 120.0 through 130.95; and
 - b. Either:
 - Performance approach: Section 140.1; or
 - Prescriptive approach: Sections 140.2 through 140.8.
- C. **Unconditioned nonresidential buildings and process spaces.** Sections 110.910, 120.6, 130.0 through 130.4, 140.3(c), 140.6, 140.7, and 140.8 apply to all newly constructed unconditioned buildings ~~and process spaces~~ within the scope of Section ~~100100.0~~(a).
- D. **Low-rise residential buildings.**
- i. Sections applicable. Sections 150.0 through 150.1 apply to newly constructed low-rise residential buildings.
 - ii. Compliance approaches. To comply with ~~Title 24, Part 6~~ Part 6, newly constructed low-rise residential buildings must meet the requirements of:
 - a. Mandatory measures: The applicable provisions of Sections 110.0 through 110.9, 120.7, and 150.0; and
 - b. Either:
 - Performance approach: Section 150.1(a) ~~through and (b)~~; or
 - Prescriptive approach: Section 150.1(a) and ~~(c)~~.

EXCEPTION 1 to Section ~~100100.0~~(e)2Diib: Seasonally occupied agricultural housing limited by state or federal agency contract to occupancy not more than 180 days in any calendar year.

EXCEPTION 2 to Section ~~100100.0~~(e)2Diib: Low-rise residential buildings that are heated with a wood heater or another non-mechanical heating system and that use no energy obtained from depletable sources for lighting or water heating.

E. Covered Processes.

- i. Sections applicable. Sections 120.6 and 140.9 apply to covered processes.
- ii. Compliance approaches. In order to comply with Part 6, covered processes must meet the requirements of:
 - a. The applicable mandatory measures in Section 120.6; and
 - b. Either:
 - the Performance approach requirements of Section 140.1; or
 - the Prescriptive approach requirements of Section 140.9.

Note: If covered processes do not have prescriptive requirements, then only the applicable mandatory measures in Section 120.6 must be met.

3. **New construction in existing buildings.**
 - A. **Nonresidential, high-rise residential, and hotel/motel buildings.** Section 1491.0 applies to new construction in existing buildings that will be nonresidential, high-rise residential, and hotel/motel occupancies.
 - B. **Low-rise residential buildings.** Section 1502 applies to new construction in existing buildings that will be low-rise residential occupancies.
 4. **Installation of insulation in existing buildings.** Section 110.8(d) applies to buildings in which insulation is being installed in existing attics, or on existing water heaters, or existing space conditioning ducts.
 5. **Outdoor Lighting.** Sections 110.9, 130.0, 130.2, 130.4, 140.7, and 150.0 apply to newly constructed outdoor lighting systems, and Section 1491.0 applies to outdoor lighting that is either added or altered.
 6. **Signs.** Sections 130.0, 130.3 and 140.8 apply to newly constructed signs located either indoors or outdoors and Section 1491.0 applies to sign alterations located either indoors or outdoors.
- (f) **Mixed Occupancy.** When a building is designed and constructed for more than one type of occupancy (residential and nonresidential), the space for each occupancy shall meet the provisions of Title 24, Part 6 Part 6, applicable to that occupancy.
- EXCEPTION 1 to Section 100.0(f):** If one occupancy constitutes at least 80 percent of the conditioned floor area of the building, the entire building envelope, HVAC, and water heating may be designed to comply with the provisions of Title 24, Part 6 Part 6 applicable to that occupancy, provided that the applicable lighting requirements in Sections 140.6 through 140.8 or 150.0(k) are met for each occupancy and space and mandatory measures in Sections 110.0 through 130.5, and 150.0 are met for each occupancy and space.
- EXCEPTION 2 to Section 100.0(f): If one occupancy constitutes at least 90 percent of the combined conditioned plus unconditioned floor area of the building, the entire building indoor lighting may be designed to comply with only the lighting provisions of Part 6 applicable to that occupancy.
- (g) **Administrative Requirements.** Administrative requirements relating to permit requirements, enforcement by the Commission, locally adopted energy standards, interpretations, claims of exemption, approved calculation methods, rights of appeal, and certification and labeling requirements of fenestration products and roofing products are specified in California Code of Regulations, Title 24, Part 1, Sections 10-101 to 10-114.
- (h) **Certification Requirements for Manufactured Devices.** Title 24, Part 6 Part 6, limits the installation of the following manufactured devices to those that have been certified to the Energy Commission by their manufacturer, pursuant to the provisions of 20 Cal. Code of Regs., Section 1606. to meet or exceed minimum specifications or efficiencies adopted by the Commission.
1. Central air-conditioning heat pumps and other central air conditioners (Sections 110.1 and 110.2).
 2. Combination equipment: space heating and cooling, or space heating and water heating (Section 110.2(a)3).
 3. Fenestration products (Section 110.6).
 4. Fluorescent lamp ballasts (Section 110.1).
 5. Gas space heaters (Sections 110.1 and 110.2).
 6. Insulating materials and roofing products (Section 110.8).
 7. Lighting control devices and lighting control systems (Section 110.9).
 8. Oil-fired storage water heaters (Section 110.3).
 9. Other heating and cooling equipment (Sections 110.1 and 110.2).
 10. Plumbing fittings (Section 110.1).

11. Pool heaters (Section 110.4).
12. Refrigerators, refrigerator-freezers, and freezers (Section 110.1).
13. Room air conditioners (Section 110.1).
14. Slab floor perimeter insulation (Section 150.0 (I)).
15. Water heaters (Section 110.3).
16. Track lighting integral current limiter (Section 110.9(4)).
17. High efficacy LED light sources (Section 110.9(m)).
18. Ballasts for residential recessed luminaires (Section 110.9(n)).
- ~~19. Dimmable fluorescent ballasts for power adjustment factors (Section 119(e)).~~

The certification status of any such manufactured device may be confirmed only by reference to:

1. A directory published or approved by the Commission; or
2. A copy of the application for certification from the manufacturer and the letter of acceptance from the Commission staff; or
3. Written confirmation from the publisher of a Commission-approved directory that a device has been certified; or
4. A Commission-approved label on the device.

NOTE: ~~Title 24, Part 6~~ Part 6, does not require a builder, designer, owner, operator, or enforcing agency to test any certified device to determine its compliance with minimum specifications or efficiencies adopted by the Commission.

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	140.1
	Envelope (conditioned)	110.6, 110.7, 110.8	140.3		
	Envelope (unconditioned, process spaces)	—	140.3(c)		
	HVAC (conditioned)	110.2, 110.5, 120.0-120.5	140.4		
	Water Heating (conditioned)	110.3, 120.3	140.5		
	Indoor Lighting (conditioned, process spaces)	110.9, 130.0, 130.1, 130.4	140.3(c), 140.6		
	Indoor Lighting (unconditioned)	110.9, 130.0, 130.1, 130.4	140.3(c), 140.6	N.A.	
	Outdoor Lighting	110.9, 130.0, 130.2, 130.4	140.7		
	Building Electrical Power	130.5	N.A.		
	<u>Solar Ready</u>	<u>110.10</u>	<u>N.A.</u>		<u>N.A.</u>
<u>Refrigerated Warehouse Covered Processes</u>	<u>Envelope, Ventilation, Process Loads and HVAC</u>	120.6	N.A. 140.9	140.1	<u>120.6, 140.9</u> 140.1
Signs	Indoor and Outdoor	130.0, 130.3	140.8	<u>N.A.</u>	<u>141.0</u>
Low-Rise Residential	General	150.0	150.1(a, fc)	150.1(a, eb)	150.2
	Envelope (conditioned)	110.6, 110.7, 110.8, 150.0(a-g, l)			
	HVAC (conditioned)	110.2, 110.5, 150.0(h, i, m, o)			
	Water Heating (conditioned)	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.
	<u>Solar Ready</u>	<u>110.10</u>	<u>N.A.</u>	<u>N.A.</u>	<u>N.A.</u>

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

(a) **Rules of Construction.**

1. Where the context requires, the singular includes the plural and the plural includes the singular.
2. The use of "and" in a conjunctive provision means that all elements in the provision must be complied with, or must exist to make the provision applicable. Where compliance with one or more elements suffices, or where existence of one or more elements makes the provision applicable, "or" (rather than "and/or") is used.
3. "Shall" is mandatory and "may" is permissive.

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

(b) **Definitions.** Terms, phrases, words and their derivatives in ~~Title 24, Part 6~~ Part 6, shall be defined as specified in Section ~~401100.1~~ 100.1. Terms, phrases, words and their derivatives not found in Section ~~401100.1~~ 100.1 shall be defined as specified in Title 24, Part 2, Chapter 2 of the California Code of Regulations. ~~Terms, phrases, words and their derivatives not found in either Title 24, Part 6, or Chapter 2 shall be defined as specified in Title 24, Part 2, Chapter 2 of the California Building Code.~~ Where terms, phrases, words and their derivatives are not defined in any of the references above, they shall be defined as specified in *Webster's Third New International Dictionary of the English Language, Unabridged* (1987-1961 edition, through the 2002 addenda), unless the context requires otherwise.

ACCA is the Air Conditioning Contractors of America.

ACCA MANUAL D is the Air Conditioning Contractors of America document titled "Manual D - Residential Duct Systems" (ANSI/ACCA 1 Manual D – 2009)

ACCA MANUAL J is the Air Conditioning Contractors of America document ~~entitled~~ "Manual J - Residential Load Calculation, ~~Eighth Edition~~" (ANSI/ACCA 2 Manual J – 2006~~2003~~).

ACCA MANUAL S is the Air Conditioning Contractors of America document titled "Manual S - Residential Equipment Selection" (ANSI/ACCA 3 Manual S – 2004)

ACCEPTANCE REQUIREMENTS FOR CODE COMPLIANCE is a description of test procedures in the Reference Nonresidential Appendices that includes equipment and systems to be tested, functions to be tested, conditions under which the test shall be performed, the scope of the tests, results to be obtained, and measurable criteria for acceptable performance.

~~ACCENT (LIGHT) is a directional luminaire designed to highlight or spotlight objects. It can be recessed, surface mounted, or mounted to a pendant, stem, or track.~~

ACCESSIBLE is having access thereto, but which first may require removal or opening of access panels, doors, or similar obstructions.

ADDITION is any change to a building that increases conditioned floor area and conditioned volume. See also "newly conditioned space." Addition is also any change that increases the floor area ~~or and~~ volume of an unconditioned building of an occupancy group or type regulated by Part 6. Addition is also any change that increases the illuminated area of an outdoor lighting application regulated by Part 6.

AGRICULTURAL BUILDING is a structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. It is not a structure that is a place of human habitation, a place of employment where agricultural products are processed, treated or packaged, or a place used by the public.

AIR BARRIER is combination of interconnected materials and assemblies joined and sealed together to provide a continuous air-tight boundary of the building envelope that separates conditioned from unconditioned space, or that separates adjoining conditioned spaces of different occupancies or uses.

AIR CONDITIONER is an appliance that supplies cooled air to a space for the purpose of cooling objects within the space.

AIR-COOLED AIR CONDITIONER is an air conditioner using an air-cooled condenser.

AIR-HANDLING UNIT or AIR HANDLER is a blower or fan that distributes supply air to a room, space, or area.

AIR LEAKAGE is a measure of how much outside air comes into a home or building through manufactured fenestration or exterior door products. -

AIR-TO-AIR HEAT EXCHANGER is a device which will reduce the heat losses or gains that occur when a building is mechanically ventilated, by transferring heat between the conditioned air being exhausted and outside air being supplied.

AIR-SOURCE HEAT PUMP is an appliance that consists of one or more factory-made assemblies, that includes an indoor conditioning coil, a compressor, and a refrigerant-to-air heat exchanger, and that provides heating and cooling functions.

ALTERATION is any change to a building's water-heating system, space-conditioning system, lighting system, or envelope that is not an addition. Alteration is also any change that is regulated by Part 6 to an outdoor lighting system that is not an addition. Alteration is also any change that is regulated by Part 6 to signs located either indoors or outdoors.

ALTERED COMPONENT is a component that has undergone an alteration and is subject to all applicable Standards requirements.

ALTERNATIVE CALCULATION METHODS (ACMS) are the Commission's Public Domain Computer Programs, one of the Commission's Simplified Calculation Methods, or any other calculation method approved by the Commission. ACMS are also referred to as compliance software.

ALTERNATIVE CALCULATION METHODS (ACM) APPROVAL MANUAL is the document that specifies the procedures and tests required for approval of Alternative Calculation Methods.

ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE) is a measure of the percentage of heat from the combustion of gas or oil which is transferred to the space being heated during a year, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2.

ANNUNCIATED is a type of visual signaling device that indicates the on, off, or other status of a load.

ANSI is the American National Standards Institute.

ANSI C82.6-2005 is the American National Standards Institute document entitled "Ballasts for High-Intensity Discharge Lamps – Methods of Measurement" (ANSI C82.6-2005)

[ANSI/IES RP-16-10 is the document co-authored by the American National Standards Institute and the Illuminating Engineering Society of North America. Recommended Practice titled "Nomenclature and Definitions for Illuminating Engineering"](#)

ANSI Z21.10.3 is the American National Standards Institute document entitled "Gas Water Heaters, - Volume III, Storage Water Heaters ~~with~~ With input ~~Input ratings~~ Ratings above ~~Above~~ 75,000 Btu ~~per~~ Per hour ~~Hour~~," ~~2001-2011~~ (ANSI Z21.10.3-~~2001~~2011/CSA 4.3-2011).

ANSI Z21.13 is the American National Standards Institute document entitled "Gas-Fired Low Pressure Steam and Hot Water Boilers," ~~2000-2010~~ (ANSI Z21.13-~~2000~~2010/CSA 4.9-2010).

ANSI Z21.40.4A is the American National Standards Institute document entitled "Addenda 1 to ANSI Z21.40.4-1996/CGA 2.94-M96, Performance Testing and Rating of Gas-Fired, Air Conditioning and Heat Pump Appliances," ~~1996-1998~~ (ANSI Z21.40.4-~~1996~~1998/CGA 2.94A-M98).

ANSI Z21.47 is the American National Standards Institute document entitled "Gas-Fired Central Furnaces," ~~2001-2006~~ (ANSI Z21.47-~~2001~~2006/CSA 2.3-2006).

ANSI Z83.8 is the American National Standards Institute document entitled "American National Standard/CSA Standard For Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces," ~~2002-2009~~ (ANSI Z83.8-~~2002~~2009/CSA 2.6-2009).

APPLIANCE EFFICIENCY REGULATIONS are the regulations in Title 20, Section 1601 et seq. of the California Code of Regulations.

APPROVED BY THE COMMISSION means approval under Section 25402.1 of the Public Resources Code.

APPROVED CALCULATION METHOD (See "alternative calculation methods")

AHRI ARI is the Air-~~e~~Conditioning, Heating, and Refrigeration Institute.

[AHRI ARI-210/240](#) is the Air-conditioning, Heating, and Refrigeration Institute document entitled "Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment," 2003~~8~~ (ANSI/AHRI Standard 210/240-20032008 with Addendum 1).

[ANSI/AHRI/CSA ARI-310/380](#) is the Air-~~e~~Conditioning, Heating, and Refrigeration Institute document entitled "Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)," ~~1993-2004~~ (ANSI/AHRI/CSA Standard 310/380-~~93~~2004).

[AHRI ARI-320](#) is the Air-~~e~~Conditioning, Heating, and Refrigeration Institute document entitled "Water-Source Heat Pumps," 1998 (AHRI Standard 320-1998).

[AHRI ARI-325](#) is the Air-~~e~~Conditioning, Heating, and Refrigeration Institute document entitled "Ground Water-Source Heat Pumps," 1998 (ARI Standard 325-1998).

ANSI/AHRI ARI-340/360 is the Air-eConditioning, Heating, and Refrigeration Institute document entitled “Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment,” 2007 (ANSI/AHRI Standard 340/360-2007 with Addenda 1 and 2).

ANSI/AHRI ARI-365 is the Air-Ceonditioning, Heating, and Refrigeration Institute document entitled, "Commercial and Industrial Unitary Air-Conditioning Condensing Units," 20029 (ANSI/AHRI Standard 365 (I-P)-20029).

ANSI/AHRI ARI-460 is the Air-eConditioning, Heating, and Refrigeration Institute document entitled “Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers,” 2005 (ANSI/AHRI Standard 460-2005).

AHRI ARI-550/590 is the Air-eConditioning, Heating, and Refrigeration Institute document entitled “Performance Rating Standard for Water Chilling Packages Using the Vapor Compression Cycle,” 1998-2003 (AHRI Standard 550/590-982003).

ANSI/AHRI ARI-560 is the Air-eConditioning, Heating, and Refrigeration Institute document entitled “Absorption Water Chilling and Water Heating Packages,” 2000 (ANSI/AHRI Standard 560-2000).

AHRI 680 is the Air-Conditioning, Heating, and Refrigeration Institute document titled “Performance Rating of Residential Air Filter Equipment,” 2009 (ANSI/AHRI Standard 680).

ASHRAE is the American Society of Heating, Refrigerating, and Air-conditioning Engineers.

ASHRAE CLIMATIC DATA FOR REGION X is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "ASHRAE Climatic Data for Region X, Arizona, California, Hawaii and Nevada," Publication SPCDX, 1982 and “Supplement,” 1994.

ASHRAE HANDBOOK, APPLICATIONS VOLUME is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "ASHRAE Handbook: Heating, Ventilating, and Air-Conditioning Applications" (20112003).

ASHRAE HANDBOOK, EQUIPMENT VOLUME is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "ASHRAE Handbook: Heating, Ventilating, and Air-Conditioning Systems and Equipment" (20082009).

ASHRAE HANDBOOK, FUNDAMENTALS VOLUME is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "ASHRAE Handbook: Fundamentals" (20052009).

ASHRAE STANDARD 52.2 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," 2007 (ANSI/ASHRAE Standard 52.2-2007 including ANSI/ASHRAE Addendum b to ANSI/ASHRAE Standard 52.2-2007).

ASHRAE STANDARD 55 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "Thermal Environmental Conditions for Human Occupancy," 2004 (ASHRAE Standard 55-2004).

ASHRAE STANDARD 62.2 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document entitled "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings," 2010 (ANSI/ASHRAE Standard 62.2-2010 including ANSI/ASHRAE Addenda b, c, e, g, h, i and l to ANSI/ASHRAE 62.2-2010 published in the 2011 supplement2007 (ASHRAE Standard 62.2-2007).

ASHRAE STANDARD 193 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled "Method of Test for Determining the Airtightness of HVAC Equipment," 2010 (ANSI/ASHRAE Standard 193-2010).

ASME is the American Society of Mechanical Engineers.

ASTM is the American Society for Testing and Materials.

ASTM C1167 is the American Society for Testing and Materials document entitled “Standard Specification for Clay Roof Tiles,” 1996 (ASTM C1167-96).

ASTM C1371 is the American Society for Testing and Materials document entitled “Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers,” 1998 (ASTM C1371-98).

ASTM C1583 is the American Society of Testing and Materials document entitled, “Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension” (Pull-off Method),” 2004 (ASTM C1583-04).

ASTM C177 is the American Society for Testing and Materials document entitled “Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus,” 1997 (ASTM C177-97).

ASTM C272 is the American Society for Testing and Materials document entitled “Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions,” 2001 (ASTM C272-01).

ASTM C335 is the American Society for Testing and Materials document entitled “Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation,” 1995 (ASTM C335-95).

ASTM C518 is the American Society for Testing and Materials document entitled “Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus,” 2002 (ASTM C518-02).

ASTM C55 is the American Society for Testing and Materials document entitled “Standard Specification for Concrete Brick,” 2001 (ASTM C55-01).

ASTM C731 is the American Society for Testing and Materials document entitled “Standard Test Method for Extrudability, After Package Aging of Latex Sealants,” 2000 (ASTM C731-00).

ASTM C732 is the American Society for Testing and Materials document entitled “Standard Test Method for Aging Effects of Artificial Weathering on Latex Sealants,” 2001 (ASTM C732-01).

ASTM C836 is the American Society of Testing and Materials document entitled, “Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course,” 2005 (ASTM C836-05).

ASTM D1003 is the American Society for Testing and Materials document entitled “Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics,” 2000 (ANSI/ASTM D1003-00).

ASTM D1653 is the American Society of Testing and Materials document entitled, “Standard Test Methods for Water Vapor Transmission of Organic Coating Films,” 2003 (ASTM D1653-03).

ASTM D2370 is the American Society of Testing and Materials document entitled, “Standard Test Method for Tensile Properties of Organic Coatings,” 2002 [ASTM D2370-98 (2002)].

ASTM D2824 is the American Society of Testing and Materials document entitled “Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Nonfibered, Asbestos Fibered, and Fibered without Asbestos,” 2002 (ASTM D2824-02).

ASTM D3468 is the American Society of Testing and Materials document entitled, “Standard Specification for Liquid-Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing,” 1999 (ASTM D3468-99).

ASTM D3805 is the American Society of Testing and Materials document entitled “Standard Guide for Application of Aluminum-Pigmented Asphalt Roof Coatings,” 1997 (ASTM D3805-97 (reapproved 2003)).

ASTM D4798 is the American Society for Testing and Materials document entitled “Standard Test Method for Accelerated Weathering Test Conditions and Procedures for Bituminous Materials (Xenon-Arc Method),” 2001 (ASTM D4798-01).

ASTM D522 is the American Society of Testing and Materials document entitled, “Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings,” 2001 [ASTM D522-93a (2001)].

ASTM D822 is the American Society of Testing and Materials document entitled, “Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings,” 2001 (ASTM D822-01).

ASTM D5870 is the American Society of Testing and Materials document entitled, “Standard Practice for Calculating Property Retention Index of Plastics,” 2003 [ASTM D5870-95 (2003)].

ASTM D6083 is the American Society of Testing and Materials document entitled, “Standard Specification for Liquid Applied Acrylic Coating Used in Roofing,” 2005 (ASTM D6083-05e1).

ASTM D6694 is the American Society of Testing and Materials document entitled, “Standard Specification for Liquid-Applied Silicone Coating Used in Spray Polyurethane Foam Roofing,” 2001 (ASTM D6694-01).

ASTM D6848 is the American Society of Testing and Materials document entitled “Standard Specification for Aluminum-Pigmented Emulsified Asphalt Used as a Protective Coating for Roofing,” 2002 (ASTM D6848-02).

ASTM E96 is the American Society for Testing and Materials document entitled “Standard Test Methods for Water Vapor Transmission of Materials,” 200 (ASTM E96-00).

ASTM E283 is the American Society for Testing and Materials document entitled “Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen,” 1991 (ASTM E283-91(1999)).

ASTM E408 is the American Society for Testing and Materials document entitled, “Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques,” 1971 (ASTM E408-71(2002)).

ASTM E972 is the American Society for Testing and Materials document entitled, "Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight," 1996 (ASTM E972-96(2007)).

ASTM E2178-03 is the American Society for Testing and Materials document entitled, "Standard Test Method for Air Permeance of Building Materials".

ASTM E2357-05 is the American Society for Testing and Materials document entitled, "Standard Test Method for determining air leakage of air barrier assemblies".

ATTIC is an enclosed space directly below the roof deck and above the ceiling beams.

AUTOMATIC is capable of operating without human intervention.

~~AUTOMATIC MULTI LEVEL DAYLIGHTING CONTROL is a multi level lighting control that automatically reduces lighting in multiple steps or continuous dimming in response to available daylight. This control uses one or more photosensors to detect changes in daylight illumination and then change the electric lighting level in response to the daylight changes.~~

AUTOMATED TELLER MACHINE (ATM) is any electronic information processing device which accepts or dispenses currency in connection with a credit, deposit, or convenience account without involvement by a clerk.

~~AUTOMATIC TIME SWITCH CONTROL DEVICES are devices capable of automatically turning loads off and on based on time schedules.~~

BATHROOM See “residential space type”.

BELOW-GRADE WALL is the portion of a wall, enclosing conditioned space that is below the grade line.

BUBBLE POINT is the liquid saturation temperature of a refrigerant at a specified pressure.

BUILDING is any structure or space covered by Section 100.0 of the Building Energy Efficiency Standards.

BUILDING COMMISSIONING is a systematic quality assurance process that spans the entire design and construction process, including verifying and documenting that building systems and components are planned, designed, installed, tested, operated and maintained to meet the owner’s project requirements.

BUILDING ENVELOPE is the ensemble of exterior and demising partitions of a building that enclose conditioned space.

CALL CENTER is a phone center that handles large number of phone calls including but not limited to help desk, customer and sales support, technical support, emergency response, telephone answering service, and inbound and outbound telemarketing.

~~**CAPTIVE KEY OVERRIDE** is a type of lighting control in which the key that activates the override cannot be released when the lights are in the on position.~~

CENTRAL FAN-INTEGRATED VENTILATION SYSTEM is a central forced air heating and/or cooling system which is intended to operate on a regular basis to bring in outdoor ventilation air and/or distribute air around the home for comfort and ventilation even when heating and cooling are not needed.

CERTIFIED TO THE ENERGY COMMISSION means certified under Section 1606 of Title 20 of the California Code of Regulations.

CERTIFYING ORGANIZATION is an independent organization recognized by the Commission to certify manufactured devices for performance values in accordance with procedures adopted by the Commission.

CHANDELIER is a ceiling mounted, close to ceiling, or suspended decorative luminaire that uses glass, crystal, ornamental metals, or other decorative material and that typically is used in hotel/motels, restaurants, or churches as a significant element in the interior architecture

CLIMATE ZONES are the 16 geographic areas of California for which the Commission has established typical weather data, prescriptive packages and energy budgets. Climate zones are defined by ZIP code and listed in Reference Joint Appendix JA2. Climate zone boundary descriptions are in the document "California Climate Zone Descriptions" (July 1995), incorporated herein by reference. FIGURE 100.1-A, FIGURE 100.1-A, below FIGURE 100.1-A, FIGURE 100.1-A is an approximate map of the 16 climate zones.

CLOSED-CIRCUIT COOLING TOWER is a closed-circuit cooling tower that utilizes indirect contact between a heated fluid, typically water or glycol, and the cooling atmosphere to transfer the source heat load indirectly to the air, essentially combining a heat exchanger and cooling tower into one relatively compact device.

CODES, CALIFORNIA HISTORICAL BUILDING CODE is the California Historical Building Code, California Code of Regulations, Title 24, Part 8 and Part 2 (Chapter 34).

CODES, CBC is the 2007-2010 California Building Code.

CODES, CEC is the 2007-2010 California Electric Code.

CODES, CMC is the 2007-2010 California Mechanical Code.

CODES, CPC is the 2007-2010 California Plumbing Code.

COEFFICIENT OF PERFORMANCE (COP), COOLING, is the ratio of the rate of net heat removal to the rate of total energy input, calculated under designated operating conditions and expressed in consistent units, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2.

COEFFICIENT OF PERFORMANCE (COP), HEATING, is the ratio of the rate of net heat output to the rate of total energy input, calculated under designated operating conditions and expressed in consistent units, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2.

COEFFICIENT OF PERFORMANCE (COP), HEAT PUMP is the ratio of the rate of useful heat output delivered by the complete heat pump unit (exclusive of supplementary heating) to the corresponding rate of energy input, in consistent units and as determined using the applicable test method in Appliance Efficiency Regulations or Section 110.2.

COMBUSTION EFFICIENCY is a measure of the percentage of heat from the combustion of gas or oil that is transferred to the medium being heated or lost as jacket loss.

COMMERCIAL BOILER is a boiler serving a space heating or water heating load in a commercial building.

COMMISSION is the California State Energy Resources Conservation and Development Commission.

COMPLEX MECHANICAL SYSTEMS: are systems that include 1) fan systems each serving multiple thermostatically controlled zones; or 2) built-up air handler systems (non-unitary or non-packaged HVAC equipment); or 3) hydronic or steam heating systems; or 4) hydronic cooling systems. Complex systems are NOT the following: (a) unitary or packaged equipment listed in Tables 110.2-A, 110.2-B, 110.2-C, and 110.2-E that each serve one zone, or (b) two-pipe, heating only systems serving one or more zones.

COMPLIANCE SOFTWARE is software that has been approved pursuant to Section 10-109 of Part 1 of Title 24 of the California Code of Regulations, to demonstrate compliance with the performance approach of Part 6.

COMPUTER ROOM is a room whose primary function is to house electronic equipment and that has a design equipment power density exceeding 20 watts/ft² (215 watts/m²) of conditioned floor area.

CONDENSER SPECIFIC EFFICIENCY is the full load condenser Total Heat of Rejection (THR) capacity at standardized conditions divided by the fan input electric power (including but not limited to spray pump electric input power for evaporative condensers) at 100% rated fan speed.

CONDITIONED FLOOR AREA (CFA) is the floor area (in square feet) of enclosed conditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned space.

CONDITIONED SPACE is space in a building that is either directly conditioned or indirectly conditioned.

CONDITIONED SPACE, DIRECTLY is an enclosed space that is provided with wood heating, is provided with mechanical heating that has a capacity exceeding 10 Btu/hr-ft², or is provided with mechanical cooling that has a capacity exceeding 5 Btu/hr-ft², unless the space conditioning system is designed for a process space. (See “process space”)

CONDITIONED SPACE, INDIRECTLY is enclosed space, including, but not limited to, unconditioned volume in atria, that (1) is not directly conditioned space; and (2) either (a) has a thermal transmittance area product (UA) to directly conditioned space exceeding that to the outdoors or to unconditioned space and does not have fixed vents or openings to the outdoors or to unconditioned space, or (b) is a space through which air from directly conditioned spaces is transferred at a rate exceeding three air changes per hour.

CONDITIONED VOLUME is the total volume (in cubic feet) of the conditioned space within a building.

CONTINUOUS DIMMING (See “dimming, continuous”)

CONTINUOUS INSULATION is exterior or interior insulation of board, sheet, insulated siding, or field applied material that: (a) is continuous across all structural and nonstructural framing assemblies that separates conditioned from unconditioned space, and (b) has no thermal bridges other than fasteners and necessary building penetrations.

CONTROLLED ATMOSPHERE is an airtight space maintained at reduced oxygen levels for the purpose of reducing respiration of perishable product in long term storage.

COOLER is a space to be capable of operation at a temperature greater than or equal to 28°F but less than 55°F.

COOL ROOF is a roofing material with high thermal emittance and high solar reflectance, or low thermal emittance and exceptionally high solar reflectance as specified in Section 110.8(i) that reduces heat gain through the roof.

COOLING EQUIPMENT is equipment used to provide mechanical cooling for a room or rooms in a building.

CRAWL SPACE is a space immediately under the first floor of a building adjacent to grade.

CRRC-1 is the Cool Roof Rating Council document entitled “Product Rating Program Manual.”

CTI is the Cooling Technology Institute.

CTI ATC-105 is the Cooling Technology Institute document entitled “Acceptance Test Code for Water Cooling Towers,” 2000 (CTI ATC-105-00).

CTI ATC-105S(96) is the Cooling Technology Institute document entitled “Acceptance Test Code for Closed-Circuit Cooling Towers,” 1996 (CTI ATC-105-96).

CTI STD-201 is the Cooling Technology Institute document entitled “Standard for ~~the Certification of Water Cooling Tower~~ Thermal Performance Certification of Evaporative Heat Rejection Equipment,” 2004 ~~1109~~ (CTI STD-201-~~041109~~).

CURRENT AIR DEMAND is the actual cubic feet per minute (acfm) of total airflow, necessary for end uses in a compressed air system.

C-VALUE (also known as C-factor) is the time rate of heat flow through unit area of a body induced by a unit temperature difference between the body surfaces, in Btu (hr x ft² x °F). It is not the same as K-value or K-factor.

CYCLES OF CONCENTRATION Cycles of concentration is a measurement of the concentration of total dissolved solids (TDS) in tower water. Because evaporation of pure water leaves dissolved solids behind in the system water, TDS increases over time as the tower operates. The number of times the dissolved minerals are concentrated is relative to the TDS in the makeup water. For example, 5 cycles of concentration represents five times the concentration of solids in the tower system water relative to the TDS in the make up water entering the tower.

DAYLIGHT AREA DAYLIT ZONE is the floor area under skylights or next to windows. ~~The daylight area~~ Types of Daylit Zones includes Primary Sidelit ~~Daylight Area Daylit Zone~~, Secondary Sidelit ~~Daylight Area Daylit Zone~~, and Skylit ~~Daylight Area Daylit Zone~~.

DEADBAND is the temperature range within which the HVAC system is neither calling for heating or cooling.

DECORATIVE GAS APPLIANCE is a gas appliance that is designed or installed for visual effect only, cannot burn solid wood, and simulates a fire in a fireplace.

DEGREE DAY, HEATING, is a unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal annual heating load of a building. For any one day, when the mean temperature is less than 65°F, there exist as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65°F. The number of degree days for specific geographical locations are those listed in the Reference Joint Appendix JA2. For those localities not listed in the Reference Joint Appendix JA2, the number of degree days is as determined by the applicable enforcing agency.

~~**DEMAND RESPONSE** is controlling electricity loads in buildings in response to an electronic signal sent by the local utility requesting their customers to reduce electricity consumption.~~

DEMAND RESPONSE is short-term changes in electric usage by end-use customers, from their normal consumption patterns. Demand response may be in response to:

- a. changes in the price of electricity; or
- b. participation in programs or services designed to modify electricity use
 - i. in response to wholesale market prices or
 - ii. when system reliability is jeopardized.

~~**DEMAND RESPONSE PERIOD** is a period of time during which the local utility is curtailing electricity loads are modified in response to by sending out a demand response signal.~~

~~**DEMAND RESPONSE SIGNAL** is an electronic signal sent out by the local utility indicating a request to their customers to curtail electricity consumption.~~

DEMAND RESPONSE SIGNAL is a signal sent by the local utility, Independent System Operator (ISO), or designated curtailment service provider or aggregator, to a customer, indicating a price or a request to modify electricity consumption, for a limited time period.

~~**DEMAND RESPONSIVE LIGHTING CONTROL** is a control that reduces lighting power consumption in response to a demand response signal.~~

DEMAND RESPONSIVE CONTROL is a kind of control that is capable of receiving and automatically responding to a demand response signal.

DEMISING PARTITION is a wall, fenestration, floor, or ceiling that separates conditioned space from enclosed unconditioned space.

DESIGN CONDITIONS are the parameters and conditions used to determine the performance requirements of space-conditioning systems. Design conditions for determining design heating and cooling loads are specified in Section 140.4(b) for nonresidential, high-rise residential, and hotel/motel buildings, and in Section 150.0(h) for low-rise residential buildings.

DESIGN HEAT GAIN RATE is the total calculated heat gain through the building envelope under design conditions.

DESIGN HEAT LOSS RATE is the total calculated heat loss through the building envelope under design conditions.

~~**DIMMING, CONTINUOUS** is a lighting control method that is capable of varying the light output of lamps over a continuous range from full light output to minimum light output.~~

~~**DIMMING, STEPPED** is a lighting control method that varies the light output of lamps in one or more predetermined discrete steps between full light output and off.~~

DESIGN REVIEW is a secondary review of the construction documents (drawings and specifications) that seeks to improve compliance with existing Title 24 regulations, to encourage adoption of best practices in design, and to encourage designs that are constructable and maintainable. It is an opportunity for an experienced design engineer to look at a project with a fresh perspective in an effort to catch missing or unclear design information and to suggest design enhancements.

DEW POINT is the refrigerant vapor saturation temperature at a specified pressure.

DIRECT DIGITAL CONTROL (DDC) is a type of control where controlled and monitored analog or binary data, such as temperature and contact closures, are converted to digital format for manipulation and calculations by a digital computer or microprocessor, then converted back to analog or binary form to control mechanical devices.

~~**DIRECT DIGITAL CONTROL (DDC)** is a type of control where controlled and monitored analog or binary data, such as temperature and contact closures, are converted to digital format for manipulation and calculations by a digital computer or microprocessor, then converted back to analog or binary form to control mechanical devices.~~

~~**DISPLAY LIGHTING** is lighting confined to the area of a display that provides a higher level of illuminance than the level of surrounding ambient illuminance.~~

DISPLAY PERIMETER is the length of an exterior wall in a Group B; Group F, Division 1; or Group M₂ Occupancy that immediately abuts a public sidewalk, measured at the sidewalk level for each story that abuts a public sidewalk.

DOOR is an operable opening in the building envelope that is not a fenestration product component, including swinging and roll-up doors, fire doors, and access hatches. ~~Doors that are more than one half glass in area are considered a fenestration product glazed door.~~

DUCT SEALING is a procedure for installing a space conditioning distribution system that minimizes leakage of air from or to the distribution system. Minimum specifications for installation procedures, materials, diagnostic testing and field verification are contained in the Reference Residential Appendix RA3 and Reference Nonresidential Appendix NA1.

DUCT SYSTEM is all the ducts, duct fittings, plenums, and fans when assembled to form a continuous passageway for the distribution of air.

DUCTED SYSTEM is an air conditioner or heat pump, either a split system or single-packaged unit, that is designed to be permanently installed equipment and delivers conditioned air to an indoor space through a duct.

DWELLING is a.....(NEEDS A DEFINITION) Dwelling is used in used in **Section 150.2(a)1C and Section 150.2(a)2C**

EAST-FACING (See “orientation”)

ECONOMIZER, AIR, is a ducting arrangement, including dampers, linkages, and an automatic control system that allows a cooling supply fan system to supply outside air to reduce or eliminate the need for mechanical cooling.

ECONOMIZER, WATER, is a system by which the supply air of a cooling system is cooled directly or indirectly by evaporation of water, or other appropriate fluid, in order to reduce or eliminate the need for mechanical cooling.

EFFECTIVE TRIM CAPACITY is the (continuous) range within 15% of the minimum specific power for a compressor (kW/100acfm).

~~**EFFECTIVE APERTURE (EA)** is a measure of the extent that vertical glazing or skylights are effective for providing daylighting.~~

~~**EFFICACY, LAMP** is the quotient of rated initial lamp lumens divided by the rated lamp power (watts), without including auxiliaries such as ballasts, transformers, and power supplies.~~

ELECTRONICALLY-COMMUTATED MOTOR is a brushless DC motor with a permanent magnet rotor that is surrounded by stationary motor windings, and an electronic controller that varies rotor speed and direction by sequentially supplying DC current to the windings.

EMITTANCE, THERMAL is the ratio of the radiant heat flux emitted by a sample to that emitted by a blackbody radiator at the same temperature.

ENCLOSED SPACE is space that is substantially surrounded by solid surfaces, including walls, ceilings or roofs, doors, fenestration areas, and floors or ground.

ENERGY BUDGET is the maximum amount of Time Dependent Valuation (TDV) energy that a proposed building, or portion of a building, can be designed to consume, calculated with the approved procedures specified in ~~Title 24, Part 6~~ Part 6.

ENERGY EFFICIENCY RATIO (EER) is the ratio of net cooling capacity (in Btu/hr) to total rate of electrical energy input (in watts), of a cooling system under designated operating conditions, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2.

ENERGY FACTOR (EF) of a water heater is a measure of overall water heater efficiency, as determined using the applicable test method in the Appliance Efficiency Regulations.

ENERGY MANAGEMENT CONTROL SYSTEM (EMCS) is ~~often~~ a computerized control system designed to regulate the energy consumption of a building by controlling the operation of energy consuming systems, such as the heating, ventilation and air conditioning (HVAC), lighting, and water heating systems. The EMCS ~~is~~ must also be capable of monitoring environmental and system loads, and adjusting HVAC operations in order to optimize energy usage and respond to demand response signals.

ENERGY OBTAINED FROM DEPLETABLE SOURCES is electricity purchased from a public utility, or any energy obtained from coal, oil, natural gas, or liquefied petroleum gases.

ENERGY OBTAINED FROM NONDEPLETABLE SOURCES is energy that is not energy obtained from depletable sources.

ENFORCEMENT AGENCY is the city, county, or state agency responsible for issuing a building permit.

ENTIRE BUILDING is the ensemble of all enclosed space in a building, including the space for which a permit is sought, plus all existing conditioned and unconditioned space within the structure.

ENVELOPE (See “building envelope”)

EXFILTRATION is uncontrolled outward air leakage from inside a building, including leakage through cracks and interstices, around windows and doors, and through any other exterior partition or duct penetration.

EXTERIOR DOOR is a door through an exterior partition that is opaque or has a glazed area that is less than or equal to one-half of the door area. Doors with a glazed area of more than one half of the door area are treated as a fenestration product.

EXTERIOR FLOOR/SOFFIT is a horizontal exterior partition, or a horizontal demising partition, under conditioned space. For low-rise residential occupancies, exterior floors also include those on grade.

EXTERIOR PARTITION is an opaque, translucent, or transparent solid barrier that separates conditioned space from ambient air or space that is not enclosed. For low-rise residential occupancies, exterior partitions also include barriers that separate conditioned space from unconditioned space, or the ground.

EXTERIOR ROOF/CEILING is an exterior partition, or a demising partition, that has a slope less than 60 degrees from horizontal, that has conditioned space below, and that is not an exterior door or skylight.

EXTERIOR ROOF/CEILING AREA is the area of the exterior surface of exterior roof/ceilings.

EXTERIOR WALL is any wall or element of a wall, or any member or group of members, which defines the exterior boundaries or courts of a building and which has a slope of 60 degrees or greater with the horizontal plane. An exterior wall or partition is not an exterior floor/soffit, exterior door, exterior roof/ceiling, window, skylight, or demising wall.

EXTERIOR WALL AREA is the area of the opaque exterior surface of exterior walls.

FACTORY ASSEMBLED COOLING TOWERS are cooling towers constructed from factory-assembled modules either shipped to the site in one piece or put together in the field.

FENESTRATION:

Includes the following:

ALTERATION is any change to an existing building's exterior fenestration or glazed door component that is not a repair (see Fenestration Repair) and requires a permit and:

A. Replaces an existing fenestration or existing glazing with no area added is considered an alteration and is subject to the Alteration Section in Part 6; or

B. Replaces the existing fenestration or existing glazing and adds new area in which increases or decreases the overall rough opening of the window frame. It is considered an alteration and is subject to the Alteration Section in Part 6.

New Added Window

A. When new fenestration area is added to an existing or new exterior opaque surface or door it is not considered an alteration and is subject to the maximum window wall ration in Part 6.

ALTERED COMPONENT is a new fenestration component that has undergone an alteration other than a repair and is subject to all applicable Standards requirements.

ACE is an NFRC–Approved Calculation Entity (ACE) that verifies and approves the Component Modeling Approach reports and issues NFRC Certified Label Certificates.

FENESTRATION, BAY WINDOW is a combination assembly which is composed of three or more individual windows either joined side by side or installed within opaque assemblies and which projects away from the wall on which it is installed. Center windows, if used are parallel to the wall on which the bay is installed. ~~The end panels or~~ two side windows are angled with respect to the center window(s). Common angles are 30° and 45°, although other angles are sometimes employed.

CMA ~~is the~~ (Component Modeling Approach) is a Fenestration Product Certification Program from the National Fenestration Rating Council (NFRC) which enables energy-related performance ratings for nonresidential fenestration products, including ~~is~~ U-factor, SHGC, and VT.

CMAST (Component Modeling Approach Software Tool) is an NFRC approved software which allows a user to create a fenestration product “virtually,” and generate its energy-related performance ratings, including U-Factor, SHGC, VT.

CURTAIN WALL/STOREFRONT is an external nonbearing wall intended to separate the exterior non-conditioned and interior conditioned spaces, ~~which include~~ may consist entirely (or principally) a combination of framing materials, glass and glazing, opaque in fill and other surfacing materials supported by or within a framework.

DOORS, GLAZED are doors that are more than one-half glass in area and are considered a glazed door.

FENESTRATION, DUAL-GLAZED GREENHOUSE WINDOWS is a double glass pane separated by an air or other gas space ~~kind of dual-glazed fenestration product~~ which adds conditioned volume but not conditioned floor area to a building.

DYNAMIC GLAZING is ~~any~~Any fenestration product ~~glazing system/glazing in fill~~ that has the fully reversible with the ability to change its performance properties by tinting or darkening the pane of glass, including U-factor, SHGC, or VT. This includes, but is not limited to, shading systems between the glazing layers and chromogenic glazing.

FAÇADE is the contiguous exterior of a building surface, but not limited to fenestration products, a contiguous building surface that has a constant orientation for fenestration purposes.

FENESTRATION PRODUCT is any transparent or translucent material plus any sash, frame, mullions and dividers, in the envelope of a building, including, but not limited to, windows, sliding glass doors, French doors, skylights, curtain walls, garden windows, glass block, and any doors with a glazed area of more than one half of the door area.

FENESTRATION REPAIR shall not increase the preexisting energy consumption of the repaired component, system, or equipment. Replacement of any component, system, or equipment for which there are requirements in the Standards is considered an alteration (see Fenestration, Alterations) and not a repair (i.e. is the reconstruction of an existing broken window or window component and the intent is not to increase or decrease the existing rough opening or altered the attached framing) and subject to the Part 6 of the Standards.

FENESTRATION SYSTEM is a collection of fenestration products, but not limited to, windows, sliding glass doors, French doors, skylights, curtain walls, garden windows, glass block, and any doors with a glazed area of more than one half of the door area. ~~in the design of a building (See “fenestration product?”)~~

FIELD-FABRICATED is a fenestration product is a glazed exterior door whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site-built fenestration.

FIN is an contiguous opaque surface, oriented vertically and projecting outward horizontally from an exterior vertical surface.

FIN OFFSET is the horizontal distance from the edge of exposed exterior glazing at the jamb of a window to the fin.

FIN PROJECTION is the horizontal distance, measured outward horizontally, from the surface of exposed exterior glazing at the jamb of a window to the outward edge of a fin.

FIXED is fenestration that is not designed to be opened or closed.

FENESTRATION, GREENHOUSE/or-GARDEN WINDOW is a window unit that consists of a ~~three~~four-dimensional sided greenhouse or, five-sided garden window structure, with or without an operating sash and creates conditioned volume but no conditioned floor area to a building, also known as greenhouse window.

MANUFACTURED is a fenestration product constructed of materials which are factory cut or otherwise factory formed with the specific intention of being used to fabricate a fenestration product. However a “knocked-down or partially assembled product, sold as a fenestration product is also a manufactured fenestration product when provided with temporary and permanent labels as described in Section 10-111; otherwise it is a site-built fenestration product when provided with temporary and permanent labels as described in Section 10-111.

NFRC 100 is the National Fenestration Rating Council document entitled “NFRC 100: Procedure for Determining Fenestration Product U-factors.” (2010; NFRC 100 includes procedures for site fenestration formerly included in a separate document, NFRC 100-SB).

NFRC 200 is the National Fenestration Rating Council document entitled “NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence.” (2010).

~~NFRC 400~~ is the National Fenestration Rating Council document entitled “NFRC 400: Procedure for Determining Fenestration Product Air Leakage.” (2010).

~~NFRC 700~~ is Component Modeling Approach (CMA) Product Certification Program (PCP) procedures. (2010)

OPERABLE is fenestration that is designed to be opened or closed.

OPERABLE SHADING DEVICE is a device at the interior or exterior of a building or integral with a fenestration product, which is capable of being operated, either manually or automatically, to adjust the amount of solar radiation admitted to the interior of the building.

OVERHANG is a contiguous opaque surface, oriented horizontally and projecting outward horizontally from an exterior vertical surface.

OVERHANG OFFSET is the vertical distance from the edge of exposed exterior glazing at the head of a window to the overhang.

OVERHANG PROJECTION is the horizontal distance, measured outward horizontally from the surface of exposed exterior glazing at the head of a window to the outward edge of an overhang.

SITE-BUILT is fenestration designed to be field-glazed or field assembled units using specific factory cut or otherwise factory formed framing and glazing units, that are manufactured with the intention of being assembled at the construction site. These include storefront systems, curtain walls, and atrium roof systems.

SOLAR HEAT GAIN COEFFICIENT (SHGC) is the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.

SOLAR HEAT GAIN COEFFICIENT, CENTER OF GLAZING (SHGC_c) is the SHGC for the center of glazing area.

SOLAR HEAT GAIN COEFFICIENT, TOTAL FENESTRATION PRODUCT (SHGC_t or SHGC_T) is the SHGC for the total fenestration product.

U-FACTOR, FENESTRATION is the overall coefficient of thermal transmittance of a construction assembly, in Btu/(hr x ft² x °F), including air film resistance at both surfaces.

~~U FACTOR, CENTER OF GLAZING (U_c) is the U-factor for the center of glazing area.~~

U-FACTOR, TOTAL FENESTRATION PRODUCT (U_t) is the U-actor for the total fenestration product.

VISIBLE TRANSMITTANCE (VT) is the ratio (expressed as a decimal) of visible light that is transmitted through a glazing fenestration to the light that strikes the material fenestration. For products with the scope of NFRC 200, visible transmittance shall be calculated in NFRC 200. For products not within the scope of NFRC 200 (diffusing and projecting glazing's), visible transmittance shall be the solar photometric transmittance of the glazing material(s) determined in accordance with NFRC 202 or ASTM E972.

VISIBLE TRANSMITTANCE, CENTER OF GLAZING (VT_c) is the VT for the center of glazing area.

VISIBLE TRANSMITTANCE, TOTAL FENESTRATION PRODUCT (VT or VT_t) is the VT for the total fenestration product.

FENESTRATION PRODUCT is any transparent or translucent material plus any sash, frame, mullions and dividers, in the envelope of a building, including, but not limited to, windows, sliding glass doors, French doors, skylights, curtain walls, garden windows, and other doors with a glazed area of more than one half of the door area.

FENESTRATION PRODUCT, FIELD FABRICATED is a fenestration product including a glazed exterior door whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site built fenestration with a label certificate or products required to have temporary or permanent labels.

FENESTRATION PRODUCT, MANUFACTURED is a fenestration product constructed of materials which are factory cut or otherwise factory formed with the specific intention of being used to fabricate a fenestration product. A manufactured fenestration product is typically factory assembled before delivery to a job site. However a "knocked down" or partially assembled product sold as a fenestration product is also a manufactured fenestration product when provided with temporary and permanent labels as described in Section 10-111; otherwise it is a site built fenestration product when provided with temporary and permanent labels as described in Section 10-111.

FENESTRATION PRODUCT, SITE-BUILT is fenestration designed to be field glazed or field assembled units using specific factory cut or otherwise factory formed framing and glazing units. Examples of site built fenestration include storefront systems, curtain walls, and atrium roof systems.

FENESTRATION SYSTEM is a collection of fenestration products included in the design of a building. (See "fenestration product")

FIELD ERECTED COOLING TOWERS are cooling towers which are custom designed for a specific application and which cannot be delivered to a project site in the form of factory assembled modules due to their size, configuration, or materials of construction.

FIREPLACE is a hearth and fire chamber, or similar prepared place, in which a fire may be made and which is built in conjunction with a flue or chimney, including but not limited to factory-built fireplaces, masonry fireplaces, and masonry heaters as further clarified in the CBC.

FLOOR/SOFFIT TYPE is a type of floor/soffit assembly having a specific heat capacity, framing type, and U-factor.

FLUID COOLER is a fan-powered heat rejection device that includes a water circuit connected by a closed circulation loop to a water-cooled refrigerant condenser, and may be either evaporative-cooled or air-cooled.

FLUX is the rate of energy flow per unit area.

FOOD PREPARATION EQUIPMENT is cooking equipment intended for commercial use, including coffee machines, espresso coffee makers, conductive cookers, food warmers including heated food servers, fryers, griddles, nut warmers, ovens, popcorn makers, steam kettles, ranges, and cooking appliances for use in commercial kitchens, restaurants, or other business establishments where food is dispensed.

FREEZER is a space designed to be capable of operation at less than 28°F.

GAS COOLING EQUIPMENT is cooling equipment that produces chilled water or cold air using natural gas or liquefied petroleum gas as the primary energy source.

GAS HEATING SYSTEM is a natural gas or liquefied petroleum gas heating system.

GAS LOG is a self-contained, free-standing, open-flame, gas-burning appliance consisting of a metal frame or base supporting simulated logs, and designed for installation only in a vented fireplace.

GENERAL LIGHTING is lighting designed to provide a substantially uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect. When designed for lower than task illuminance used in conjunction with other specific task lighting systems, it is also called "ambient" lighting.

GLAZING (See "fenestration product")

GLOBAL WARMING POTENTIAL or "(GWP)" is the radiative forcing impact of one mass-based unit of a given greenhouse gas relative to an equivalent unit of carbon dioxide over a given period of time.

GLOBAL WARMING POTENTIAL VALUE (GWP Value) is the 100-year GWP value published by the Intergovernmental Panel on Climate Change (IPCC) in either its Second Assessment Report (SAR) (IPCC, 1995), or its Fourth Assessment A-3 Report (AR4) (IPCC, 2007). Both the 1995 IPCC SAR values and the 2007 IPCC AR4 values are published in table 2.14 of the 2007 IPCC AR4. The SAR GWP values are found in column "SAR (100-yr)" of Table 2.14.; the AR4 GWP values are found in column "100 yr" of Table 2.14."

GOVERNMENTAL AGENCY is any public agency or subdivision thereof, including, but not limited to, any agency of the state, a county, a city, a district, an association of governments, or a joint power agency.

GROSS EXTERIOR ROOF AREA is the sum of the skylight area and the exterior roof/ceiling area.

GROSS EXTERIOR WALL AREA is the sum of the window area, door area, and exterior wall area.

GU 24 is the designation of a lamp holder and socket configuration, based on a coding system by the International Energy Consortium, where "G" indicates the broad type of two or more projecting contacts, such as pins or posts, "U" distinguishes between lamp and holder designs of similar type but that are not interchangeable due to electrical or mechanical requirements, and "24" indicates 24 millimeters center to center spacing of the electrical contact posts.

HABITABLE SPACE is building space intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms.

HABITABLE STORY is a story that contains space in which humans may work or live in reasonable comfort, and that has at least 50 percent of its volume above grade.

HEAT CAPACITY (HC) is the amount of heat necessary to raise the temperature of all the components of a unit area in an assembly by 1°F. It is calculated as the sum of the average thickness times the density times the specific heat for each component, and is expressed in Btu/ft²-°F.

HEAT PUMP is an appliance, other than a packaged terminal heat pump, that consists of one or more assemblies; that uses an indoor conditioning coil, a compressor, and a refrigerant-to-outdoor air heat exchanger to provide air heating; and that may also provide air cooling, dehumidifying, humidifying, circulating, or air cleaning-a device that is capable of heating by refrigeration, and that may include a capability for cooling.

HEATED SLAB FLOOR is a concrete slab floor or a lightweight concrete topping slab lay over a raised floor, with embedded space heating by any means. The heating system using the heated slab floor is sometimes referred to as radiant slab floors or radiant heating.

HEATING EQUIPMENT is equipment used to provide mechanical heating for a room or rooms in a building.

HEATING SEASONAL PERFORMANCE FACTOR (HSPF) is the total heating output of a central air-conditioning heat pump (in Btu) during its normal use period for heating divided by the total electrical energy input (in watt-hours) during the same period, as determined using the applicable test method in the Appliance Efficiency Regulations.

HI is the Hydronics Institute of the Gas Appliance Manufacturers Association (GAMA).

HI HTG BOILER STANDARD is the Hydronics Institute document entitled "Testing and Rating Standard for Rating Boilers," 1989.

HIGH-RISE RESIDENTIAL BUILDING is a building, other than a hotel/motel, of Occupancy Group R, Division 1 with four or more habitable stories.

HOOD is a device designed to capture and contain cooking effluent including, grease, smoke, steam, heat, and vapor, until it is exhausted through a duct or recirculating system. Hoods are categorized as Type 1 or Type 2:

TYPE I HOOD is a hood used for collecting and removing convective heat, grease particulate, condensable vapor, and smoke. It includes listed grease filters, baffles, or extractors for removing the grease and a fire-suppression system. Type I hoods are installed over cooking appliances, such as ranges, fryers, griddles, broilers, and ovens, that produce smoke or grease-laden vapors. For Type I hoods, the following types of hoods are commonly available:

WALL-MOUNTED CANOPY HOOD is a type of hood that is mounted against a wall, above a single appliance or a line of appliances, or it may be free-standing with a vertical back panel extending from the rear of the appliance to the hood. A wall-mounted canopy hood typically extends beyond the front and sides of the appliance on all open sides. The wall acts as a back panel, forcing replacement air to be drawn across the front and/or side of the cooking appliance, thus increasing the effectiveness of the hood to capture and contain effluent generated by the cooking operations.

SINGLE ISLAND CANOPY HOOD is a type of hood that is placed over a single appliance or line of appliances. It is open on all sides and overhangs the front, rear, and sides of the appliance(s). A single island canopy is more susceptible to cross-drafts and requires a greater exhaust airflow than an equivalent sized wall-mounted canopy, in order to capture and contain effluent generated by the cooking operations.

DOUBLE ISLAND CANOPY HOOD is a type of hood that is placed over back-to-back appliances or lines of appliances. It is open on all sides and overhangs the front and the sides of the appliance(s). It may have a wall panel between the backs of the appliances.

BACKSHELF, PROXIMITY HOOD is a low-proximity hood, or a wall-mounted sidewall hood that:

(i) has its front lower lip located low over the appliance ;

(ii) is set back from the front of the appliance ;

(iii) is closed to the rear of the appliances by (a) a panel when the appliance is freestanding, or (b) a panel or wall when the appliance is wall mounted, and;

(iv) is located above the cooking surface.

This style of hood can be constructed with partial end panels to increase its effectiveness in capturing the effluent generated by the cooking operations.

EYEBROW HOOD is a type of hood that is mounted directly to the face or top of an appliance above the opening or door from which effluent is emitted, overhanging the front of the opening to capture the effluent.

PASS OVER HOOD is a backshelf hood constructed and installed low enough to allow food to be passed over the top of the hood.

TYPE II HOOD is a type of hood that collects and removes steam, heat, and products of combustion where grease or smoke is not present. It may have grease filters or baffles, and is not required to have a fire-suppression system.

HOTEL/MOTEL is a building or buildings ~~incorporating that has~~ six or more guest rooms or a lobby serving six or more guest rooms, where the guest rooms are intended or designed to be used, or which are used, rented, or hired out to be occupied, or which are occupied for sleeping purposes by guests, and all conditioned spaces within the same building envelope. Hotel/motel also includes all conditioned spaces which are (1) on the same property as the hotel/motel, (2) served by the same central heating, ventilation, and air-conditioning system as the hotel/motel, and (3) integrally related to the functioning of the hotel/motel as such, including, but not limited to, exhibition facilities, meeting and conference facilities, food service facilities, lobbies, and laundries.

HVAC SYSTEM (See ~~“space conditioning system”~~) is a space conditioning system or a ventilation system.

IESNAIES HB (See **IESNAIES** Lighting Handbook)

IESNAIES LIGHTING HANDBOOK is the Illuminating Engineering Society National Association document entitled “The **IESNAIES** Lighting Handbook: Reference and Applications, ~~Ninth-Tenth~~ Edition” (20002010).

INFILTRATION is uncontrolled inward air leakage from outside a building or unconditioned space, including leakage through cracks and interstices, around windows and doors, and through any other exterior or demising partition or pipe or duct penetration.

INSULATING SHEATHING is an insulating board or sheet material that: (a) is (i) applied to the exterior or interior of the building envelope; or (ii) integral with the exterior finish material; (b) has a core minimum R-value of R-2; and (c) ~~is installed continuously across~~ is installed continuously across framing assemblies, where those framing assemblies separate ~~ing~~ conditioned from unconditioned space.

INTEGRATED ENERGY EFFICIENCY RATIO (IEER) is a single-number performance parameter based on part load EER expressing part load efficiency established by the ANSI/AHRI Standard (2007) for air conditioning equipment on the basis of weighted operation at various load capacities for the equipment as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2. This parameter was developed by AHRI as an improvement over the previous part load performance parameter IPLV and has been in use since 1/1/2010.

INTEGRATED PART LOAD VALUE (IPLV) is a single-number figure of merit based on part load EER, ~~or COP, or kW/ton~~ expressing part load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2.

ISO STANDARD 17025 is the International Organization for Standardization document titled "General Criteria for the Competence of Testing and Calibration Laboratories", 2005 (ANS/ISO/IEC Standard 17025:2005)

ISO 13256-1 is the International Organization for Standardization document entitled "Water-source heat pumps -- Testing and rating for performance -- Part 1: Water-to-air and brine-to-air heat pumps," 1998.

LANGELIER SATURATION INDEX The Langelier Saturation Index (LSI) is expressed as the difference between the actual system pH and the saturation pH. LSI indicates whether water will precipitate, dissolve, or be in equilibrium with calcium carbonate, and is a function of hardness, alkalinity, conductivity, pH and temperature.

LARGEST NET CAPACITY INCREMENT is the largest increase in capacity when switching between combinations of base compressors that is expected to occur under the compressed air system control scheme.

KITCHEN (See residential space type.)

LIGHT EMITTING DIODE (LED) is a *pn* junction semiconductor device that emits incoherent optical radiation when biased in the forward direction. The acronym "LED" typically refers to an LED Component, LED Device, or LED Package.

Hybrid LED Luminaire is a complete lighting unit consisting of a light source and driver together with parts to distribute light, to position and protect the light source, and to connect the light source to a branch circuit. The light sources in the Hybrid LED Luminaire contain both LED Source Systems, or LED Lamps, as well as other types of light sources such as incandescent or fluorescent lamps. The Hybrid LED Luminaire is intended to be connected directly to a branch circuit.

LED Array is an assembly of LED Components, LED Devices or LED Packages on a printed circuit board or substrate, possibly with optical elements and additional thermal, mechanical, and electrical (LED Control Circuitry) interfaces that are connected to the load side of LED Driver (Power Source). LED Array does not contain an LED Driver (Power Source) and is not connected directly to the branch circuit.

LED Component (or LED Device, or LED Package) is a semiconductor die that contains wire bond connections, possibly with an optical element, or a thermal, mechanical, or electrical interface. LED Component, LED Device, or LED Package does not contain an LED Driver (Power Source) and is not connected directly to the branch circuit.

LED Control Circuitry is electronic components located between the Power Source (LED Driver) and the LED Component, or LED Device, or LED Package designed to limit voltage and current, to dim, to switch or otherwise control the electrical energy to the LED. The circuitry does not include a Power Source.

LED Driver is a power source with integral LED control circuitry designed to meet the specific requirements of an LED Lamp, an LED Array, or an LED Module. Typically LED Driver (Power Source) contains the LED Control Circuitry.

LED Lamp is an LED Component, LED Device, or LED Package and other optical, thermal, mechanical and electrical (LED Control Circuitry) components with an integrated LED Driver (Power Source) and a standardized base that is designed to connect to the branch circuit via a standardized base, lamp holder, or socket.

In North America, “a standardized base” refers to an ANSI standard base. In the U.S. “branch circuit” is used to describe the “mains voltage” in IEC documents.

NOTE: Non-integrated type of LED Lamp should not be defined, it is a LED Module.

LED Light Engine with Integral Heat Sink (or LED Light Source System) is a subsystem of an LED Luminaire that includes one or more LED Components, LED Devices or LED Packages, an LED Array, or LED Module; an LED Driver (Power Source); electrical and mechanical interfaces; and an integral heat sink to provide thermal dissipation. An LED Source System may be designed to accept additional components that provide aesthetic, optical, and environmental control (other than thermal dissipation). An LED Source System with standardized base is an LED Lamp.

LED Luminaire is a complete LED lighting unit consisting of a light source and driver together with parts to distribute light, to position and protect the light source, and to connect the light source to a branch circuit. The light source itself may be an LED Components, LED Packages or LED Devices, LED Array, an LED Module, an LED Source System, or an LED Lamp. The LED Luminaire is intended to be connected directly to a branch circuit.

LED Module is a component part of an LED Source System that includes one or more LED Components, LED Devices or LED Packages, possibly with optical elements and additional thermal, mechanical, and electrical (LED Control Circuitry) interfaces that are connected to the load side of LED Drive (Power Source). The LED Module does not contain a power source. An LED Array is equivalent to an LED Module.

LIGHTING definitions:

Accent Lighting is directional lighting designed to highlight or spotlight objects. It can be recessed, surface mounted, or mounted to a pendant, stem, or track.

Chandelier is a ceiling-mounted, close-to-ceiling, or suspended decorative luminaire that uses glass, crystal, ornamental metals, or other decorative material.

Compact Fluorescent Lamp is a fluorescent lamp less than 9 inches maximum overall length (M.O.L.) with a T5 or smaller diameter glass tube that is folded, bent, or bridged.

Decorative Lighting is lighting installed only for aesthetic purposes and that does not serve as display lighting or general lighting.

Display Lighting is lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance.

General Lighting is lighting that provides a uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect.

GU-24 is the designation of a lamp holder and socket configuration, based on a coding system by the International Energy Consortium, where “G” indicates the broad type of two or more projecting contacts, such as pins or posts, “U” distinguishes between lamp and holder designs of similar type but that are not interchangeable due to electrical or mechanical requirements, and “24” indicates 24 millimeters center to center spacing of the electrical contact posts.

Illuminance is the incident luminous flux density on a differential element of surface located at a point and oriented in a particular direction, expressed in lumens per unit area.

Illumination is light incident on a surface of body, or the general condition of being illuminated.

Lamp is an electrical appliance that produces optical radiation for the purpose of visual illumination, designed with a base to provide an electrical connection between the lamp and a luminaire, and designed to be installed into a luminaire by means of a lamp-holder integral to the luminaire.

Lantern is an outdoor luminaire that uses an electric lamp to replicate the appearance of a pre-electric lantern, which used a flame to generate light.

Light is the luminous equivalent of power and is properly called luminous flux.

Lighting, or illumination, is the application of light to achieve some practical or aesthetic effect.

Light Emitting Diode (LED) definitions used in Part 6 are in section 6.8 of ANSI/IES RP-16-10.

Low Voltage is less than 90 volts.

Lumen Maintenance is a strategy used to provide a precise, constant level of lighting from a lighting system regardless of the age of the lamps or the maintenance of the luminaires.

Luminaire is a complete lighting unit consisting of lamp(s) and the parts that distribute the light, position and protect the lamp(s), and connect the lamp(s) to the power supply.

Luminance is a measure of the light emitting power of a surface, in a particular direction, per unit apparent area.

Luminous flux is visually evaluated radiant flux and defines "light" for purposes of lighting design and illuminating engineering.

Marquee lighting is a permanent lighting system consisting of one or more rows of many small lamps, including light emitting diodes (LEDs), or fiber optic lighting, attached to a canopy.

Ornamental lighting for compliance with Part 6 is the following:

Luminaires installed outdoor which are rated for 100 watts or less that are post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting.

Decorative Luminaires installed indoor that are chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights, and light color panels.

Pendant is a mounting method in which the luminaire is suspended from above.

Permanently Installed lighting consists of luminaires that are affixed to land, within the meaning of Civil Code section 658 and 660, except as provided below. Permanently installed luminaires may be mounted inside or outside of a building or site. Permanently installed luminaires may have either plug-in or hardwired connections for electric power. Examples include track and flexible lighting systems; lighting attached to walls, ceilings, columns, inside or outside of permanently installed cabinets, internally illuminated cabinets, mounted on poles, in trees, or in the ground; attached to ceiling fans and integral to exhaust fans. Permanently installed lighting does not include portable lighting or lighting that is installed by the manufacturer in exhaust hoods for cooking equipment, refrigerated cases, food preparation equipment, and scientific and industrial equipment.

Portable Lighting is lighting, with plug-in connections for electric power, that is: table and freestanding floor lamps; attached to modular furniture; workstation task luminaires; luminaires attached to workstation panels; attached to movable displays; or attached to other personal property.

Post top luminaire is an outdoor luminaire that is mounted directly on top of a lamp-post.

Precision Lighting is task lighting for commercial or industrial work that illuminates low contrast, finely detailed, or fast moving objects.

Radiant power is the time-rate-flow of radiant energy.

Radiant Energy is the electromagnetic or photonic radiant energy from a source.

SCONCE is a wall mounted decorative accent luminaire.

Source is the general term used to reference a source of light. It can refer variously to an electric lamp, a light emitting diode (LED), an entire luminaire with lamp and optical control, or fenestration for daylighting.

Task Lighting is lighting that is not general lighting and that specifically illuminates a location where a task is performed.

Temporary Lighting is a lighting installation, with plug-in connections, that does not persist beyond 60 consecutive days or more than 120 days per year.

Track Lighting is a system that includes luminaires and a track, rails, or cables that both mount the system, and deliver electric power. Track lighting includes the following types:

Line-Voltage Track Lighting is equipped with luminaires that, use line-voltage lamps or that are equipped with integral transformers at each luminaire.

Low-Voltage Track Lighting is equipped with remote transformers for use with low-voltage equipment along the entire length of track.

Track Mounted Luminaires are luminaires designed to be attached at any point along a track lighting system. Track mounted luminaires may be line-voltage or low-voltage.

Tuning is the ability to set maximum light levels at a lower level than full lighting power.

LIGHTING CONTROLS consist of the following:

Astronomical Time-Switch Control is an Automatic Time-Switch Control that controls lighting based on the time of day and astronomical events such as sunset and sunrise, accounting for geographic location and calendar date.

Automatic Daylight Control uses one or more photosensors to detect changes in daylight illumination and then automatically adjusts the luminous flux of the electric lighting system in response.

Automatic Multi-Level Daylight Control adjusts the luminous flux of the electric lighting system in either a series of steps or by continuous dimming in response to available daylight. This kind of control uses one or more photosensors to detect changes in daylight illumination and then automatically adjusts the electric lighting levels in response.

Automatic Time Switch Control controls lighting based on the time of day.

Captive-Key Override is a type of lighting control in which the key that activates the override cannot be released when the lights are in the on position.

Countdown Timer Switch turns lighting or other loads ON when activated using one or more selectable count-down time periods and then automatically turns lighting or other loads OFF when the selected time period had elapsed.

Dimmer varies the luminous flux of the electric lighting system in order to change the level energy use.

Dimmer, Full-Range varies the luminous flux of the electric lighting system over a continuous range from the device's maximum light output to the device's minimum light output, without visually apparent steps

Dimmer, Stepped varies the luminous flux of the electric lighting system in one or more predetermined discrete steps between maximum light output and OFF.

Lighting Control, Self Contained is a unitary lighting control module that requires no additional components.

Lighting Control System requires two or more components to be installed in the field to provide all of the functionality required to make up a fully functional and compliant lighting control.

Multi-Level Astronomical Time Switch is an Astronomical Time Switch Control that reduces lighting power in multiple steps.

Multi-Level Lighting Control reduces lighting power in multiple steps.

Multiscene Programmable Control allows for two or more pre-defined lighting settings, in addition to all-OFF, for two or more groups of luminaires to suit multiple activities in the space.

Occupant Sensing Controls automatically control levels of illumination, allow for manual operation, and consist of the following types:

Motion Sensor is used outdoors, automatically turns lights OFF after an area is vacated of occupants, and automatically turns the lighting load ON when the area is occupied.

Occupant Sensor is used indoors and automatically turns lights OFF after an area is vacated of occupants and is capable of automatically turning the lighting load ON when an area is occupied.

Partial-ON Occupant/Motion Sensor automatically turns lights OFF after an area is vacated of occupants and is capable of automatically or manually turning ON part of the lighting load when an area is occupied.

Partial-OFF Occupant/Motion Sensor automatically turns OFF part of the lighting load after an area is vacated of occupants and is capable of automatically turning ON the lighting load when an area is occupied.

Vacancy Sensor automatically turns lights OFF after an area is vacated of occupants but requires lighting loads to be turned ON manually.

Part-Night Outdoor Lighting Control is a time or occupancy-based lighting control device or system that reduces or turns off the lighting power to an outdoor luminaire for a portion of the night.

Photo Control automatically turns lights ON and OFF, or automatically adjusts lighting levels, in response to the amount of daylight that is available. A Photo Control may also be one component of a field assembled lighting system, the component having the capability to provide a signal proportional to the amount of daylight to a Lighting Control System to continuously dim or brighten the electric lights in response.

Track Lighting Integral Current Limiter consists of a current limiter integral to the end-feed housing of a manufactured line-voltage track lighting system.

Track Lighting Supplementary Overcurrent Protection Panel is a Panelboard containing Supplementary Overcurrent Protection Devices as defined in Article 100 of the California Electric Code, and used only with line voltage track lighting

LISTED is equipment, materials, or services included in a list published by an organization that is recognized to have the authority to evaluate and test the equipment, material or services. The organization performs periodic inspection and evaluation to ensure that the listed equipments, material, or services meet identified standards or has been tested and found suitable for a specified purpose. The recognized organizations include Underwriters Laboratories (UL) and other nationally recognized testing/rating laboratories.

LISTED definition used in Part 6 is in Article 100 of the California Electric Code.

LOW-GWP REFRIGERANT is a compound used as a heat transfer fluid or gas that is: (A) any compound or blend of compounds, with a GWP Value less than 150; and (B) U.S. EPA Significant New Alternatives Policy (SNAP)-approved; and (C) not an ozone depleting substance as defined in Title 40 of the Code of Federal Regulations, Part 82, §82.3 (as amended March 10, 2009).

LOW-RISE RESIDENTIAL BUILDING is a building, other than a hotel/motel that is of Occupancy Group R, Division 1, and is multi-family with three stories or less, or a single family residence of Occupancy Group R, Division 3, or an Occupancy Group U building located on a residential site.

LPG is liquefied petroleum gas. Propane is one type of LPG.

LUMINAIRE is a complete lighting unit consisting of a lamp(s) and the parts designed to distribute the light, to position and protect the lamp(s), and to connect the lamp(s) to the power supply; commonly referred to as "lighting fixtures."

MAKEUP AIR is outdoor air that: is intentionally conveyed by openings or ducts into the building from the outside; and is supplied to the vicinity of an exhaust hood, and; ~~to replaces air, vapor, and contaminants being exhausted by the exhaust hood. Makeup air is generally filtered and fan-forced, and it may be heated or cooled. Makeup air may be delivered through openings or ducts integral to the exhaust hood or through outlets in the same room.~~

MANUAL is capable of being operated by personal intervention.

MANUFACTURED DEVICE is any heating, cooling, ventilation, lighting, water heating, refrigeration, cooking, plumbing fitting, insulation, door, fenestration product, or any other appliance, device, equipment, or system subject to Sections 110.0 through 110.9 of ~~Title 24, Part 6~~ Part 6.

MECHANICAL COOLING is lowering the temperature within a space using refrigerant compressors or absorbers, desiccant dehumidifiers, or other systems that require energy from depletable sources to directly condition the space. In nonresidential, high-rise residential, and hotel/motel buildings, cooling of a space by direct or indirect evaporation of water alone is not considered mechanical cooling.

MECHANICAL HEATING is raising the temperature within a space using electric resistance heaters, fossil fuel burners, heat pumps, or other systems that require energy from depletable sources to directly condition the space.

MERV is the Minimum Efficiency Reporting Value as determined by ASHRAE Standard 52.2 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

METAL BUILDING is a complete integrated set of mutually dependent components and assemblies that form a building, which consists of a steel-framed superstructure and metal skin. This does not include structural glass or metal panels such as in a curtainwall system.

MICRO-CHANNEL CONDENSER is an air-cooled condenser for refrigeration systems which utilizes multiple small parallel gas flow passages in a flat configuration with uniform unfinned surfaces between the gas passages, rather than round tubes arranged at a right angle to separate plate fins.

MINI-SPLIT AIR CONDITIONERS AND HEAT PUMPS are air conditioner or heat pump systems that have a single outdoor section and one or more indoor sections. The indoor sections cycle on and off in unison in response to a single indoor thermostat.

MULTIPLE-SPLIT AIR CONDITIONERS AND HEAT PUMPS are air conditioner or heat pump systems that have two or more indoor sections. The indoor sections operate independently and can be used to condition multiple zones in response to multiple indoor thermostats.

MODELING ASSUMPTIONS are the conditions (such as weather conditions, thermostat settings and schedules, internal gain schedules, etc.) that are used for calculating a building's annual energy consumption as specified in the Alternative Calculation Methods (ACM) Approval Manuals.

MOVABLE SHADING DEVICE means (See “operable shading device”).

MULTIPLE ZONE SYSTEM is an air distribution system that supplies air to more than one thermal zone, each of which has one or more devices (such as dampers, cooling coils, and heating coils) that regulate airflow, cooling, or heating capacity to the zone.

NET EXHAUST FLOW RATE is the exhaust flow rate for a hood, minus any internal discharge makeup air flow rate.

NEWLY CONDITIONED SPACE is any space being converted from unconditioned to directly conditioned or indirectly conditioned space. Newly conditioned space must comply with the requirements for an addition. See Section 449.141.0 for nonresidential occupancies and Section 150.2 for residential occupancies.

NEWLY CONSTRUCTED BUILDING is a building that has never been used or occupied for any purpose.

NON-DUCTED SYSTEM is an air conditioner or heat pump that: is permanently installed; directly heats or cools air within the conditioned space; and uses one or more indoor coils that are mounted on walls or ceilings within the conditioned space. The system may be of a modular design that allows for combining multiple outdoor coils and compressors to create one unified system.

NFRC 100 is the National Fenestration Rating Council document entitled “NFRC 100: Procedure for Determining Fenestration Product U factors.” (2007; NFRC 100 includes procedures for site fenestration formerly included in a separate document, NFRC 100-SB)

NFRC 200 is the National Fenestration Rating Council document entitled “NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence.” (2007)

NFRC 400 is the National Fenestration Rating Council document entitled “NFRC 400: Procedure for Determining Fenestration Product Air Leakage.” (2007)

NONRESIDENTIAL BUILDING is any building which is a Group A, B, E, F, H, M, or S; and is a U Occupancy when the Group U Occupancy is on a nonresidential site.

NOTE: Requirements for high-rise residential buildings and hotels/motels are included in the nonresidential sections of Title 24, Part 6 Part 6.

NONRESIDENTIAL BUILDING OCCUPANCY TYPES are buildings in which a minimum of 90 percent of the area functions as one of the following:

Auditorium Building is a public building with fixed seating and primarily used or designed for public meetings or gatherings, not specifically for the viewing of dramatic performances.

Classroom Building is a building for which a minimum of 90 percent of the building floor area is used or designed for classrooms, educational workshops, or educational laboratories, and any ancillary corridors, stairways, and restrooms.

Commercial and Industrial Storage Building is a building for which a minimum or 90% of the building floor area is used or designed for storing items, and any ancillary corridors, stairways and restrooms.

Convention Center Building is a building primarily used or designed for meetings, conventions, or events, and has neither fixed seating nor fixed staging.

Financial Institution Building is a building primarily used or designed for conducting financial transactions.

General Commercial and Industrial Work Building is a building primarily designed or used for performing an art, craft, assembly or manufacturing operation.

Grocery Store Building is a building for the sale of foodstuffs.

Library Building is a building which is primarily a repository for literary materials, such as books, periodicals, newspapers, pamphlets and prints, kept for reading or reference.

Medical Buildings and Clinic Buildings are non “I” occupancy buildings where medical or clinical care is provided, does not provide overnight patient care, and is used to provide physical and mental care through medical, dental, or psychological examination and treatment.

Office Building is a building of CBC Group B Occupancy which is other than a restaurant.

Parking Garage Building is a building used or designed for the purpose of parking vehicles, which consists of at least a roof over the parking area enclosed with walls on all sides. Fences, rails, partial walls, or other barriers may be used in place of one or more walls. The building has at least one entrance and exit for vehicles, and includes areas for vehicle maneuvering to reach designated parking spaces. If the roof of a parking structure is also used for parking, the section without an overhead roof is considered a parking lot instead of a parking garage.

Religious Facility Building is a building in which the primary design or function is for assembly of people to worship.

Restaurant Building is a building in which the primary function is a food establishment as defined in 17 Cal. Code Regs., Section 12100.

School Building is a building that is used by an organization that provides instruction to students, which is not a Classroom Building as defined in Section 100.1, and may include an auditorium, gymnasium, kitchen, library, multi-purpose room, dining and cafeteria, student union, or maintenance staff workroom. A maintenance or storage building is not a school building.

Theater Building is a building in which the primary function is assembly, having tiers of rising seats or steps for the viewing of motion pictures, dramatic performances, lectures, musical events and similar live performances.

NONRESIDENTIAL COMPLIANCE MANUAL is the manual developed by the Commission, under Section 25402.1(e) of the Public Resources Code, to aid designers, builders, and contractors in meeting the energy efficiency requirements for nonresidential, high-rise residential, and hotel/motel buildings.

NONSTANDARD PART LOAD VALUE (NPLV) is a single-number part-load efficiency figure of merit for chillers referenced to conditions other than IPLV conditions. (See “integrated part load value”)

NORTH-FACING (See “orientation”).

NONRESIDENTIAL FUNCTION AREAS OR TYPE OF USE IS ONE OF ARE AREAS WITHIN NONRESIDENTIAL BUILDINGS DESIGNED OR USED FOR SPECIFIC PURPOSES.

EXAMPLES OF NONRESIDENTIAL FUNCTION AREAS INCLUDE THE FOLLOWING:

Aisle Way is the space between storage racks in a Commercial or Industrial Storage Building.

Atrium is a large-volume space created by openings ~~connecting between~~ two or more stories ~~and-but~~ is ~~not~~ used for ~~purposes other than~~ an enclosed stairway, ~~an~~ elevator hoistway, ~~an~~ escalator opening, or ~~as a~~ utility shaft for plumbing, electrical, air-conditioning or other equipment, and is not a mall.

Auditorium Room is ~~the part of a public building where an audience sits in fixed seating, or a room, area, or building with fixed seats used for public meetings or gatherings not specifically for the viewing of dramatic performances.~~

Auto Repair Bay is ~~the portion of a building a room or area~~ used to repair automotive equipment and/or vehicles, exchange parts, and may include work using an open flame or welding equipment.

Beauty Salon is a room or area in which the primary activity is manicures, pedicures, facials, or the cutting or styling of hair. ~~Also may be known as a beauty shop or beauty parlor.~~

Civic Meeting Place is a ~~space in a government building designed or used for public debate, discussion, or public meetings of governmental bodies. room or area which is a city council or board of supervisors meeting chamber, courtroom, or other official meeting space area accessible to the public.~~

Classroom building is a building or group of buildings that is predominately classrooms used by an organization that provides instruction to students, which may include corridors and stairways, restrooms and small storage closets, faculty offices, and workshops and labs. A classroom building does not include buildings that are not predominantly classroom, including auditorium, gymnasium, kitchen, library, multi purpose, dining and cafeteria, student union, maintenance staff workroom, or storage buildings.

Classroom, Lecture, Training, Vocational Room is a room or area where an audience or class receives instruction.

Commercial and Industrial Storage Area is a room, or area, ~~or building~~ used for storing items.

Commercial and Industrial Storage Area (refrigerated) is a room or area used for storing items where mechanical refrigeration is used to maintain the space temperature at 55° F or less.

Convention, Conference, Multipurpose and Meeting Centers is ~~an are~~ assembly rooms or areas, ~~or building that is are~~ designed or used for meetings, conventions or events, ~~and multiple purposes, including, but not limited to, dramatic performances, and that have~~ neither fixed seating nor fixed staging.

Corridor is a passageway or route into which compartments or rooms open.

Dining is a room ~~or rooms or area in a restaurant or hotel/motel (other than guest rooms)~~ where meals that are served to the customers will be consumed.

Dormitory is a building consisting of multiple sleeping quarters and having interior common areas such as dining rooms, reading rooms, exercise rooms, toilet rooms, study rooms, hallways, lobbies, corridors, and stairwells, other than high-rise residential, low-rise residential, and hotel/motel occupancies.

Electrical/Mechanical/Telephone Room is a room in which the building's electrical switchbox or control panels, telephone switchbox, and/or HVAC controls or equipment is located.

Exercise Center, or Gymnasium is a room ~~or building or area~~ equipped for gymnastics, exercise equipment, or indoor athletic activities.

Exhibit is a room or area ~~that has for its primary purpose that is used for exhibitions exhibitions, that have~~ neither fixed seating nor fixed staging. ~~An exhibit does not include a gallery or other place where art is for sale. An exhibit does not include a lobby, conference room, or other occupancies where the primary function is not exhibitions.~~

Financial institution is a public establishment used for conducting financial transactions including the custody, loan, exchange, or issue of money, for the extension of credit, and for facilitating the transmission of funds.

Financial Transaction Areas is a room or area for ~~the~~ tellers, work stations, and customers' waiting areas; to complete financial transactions. Financial transaction areas do not include private offices, hallways, restrooms, or other support areas.

General Commercial and Industrial Work Area is a room or area, ~~or building~~ in which an art, craft, assembly or manufacturing operation is performed.

High bay: ~~Where the l~~uminaires are 25 feet or more above the floor.

Low bay: ~~Where the l~~uminaires are less than 25 feet above the floor.

Precision: ~~Where involving~~ visual tasks of small size or fine detail such as electronics assembly, fine woodworking, metal lathe operation, fine hand painting and finishing, egg processing operations, or tasks of similar visual difficulty are performed.

Grocery ~~S~~ales ~~A~~rea is a room, ~~or~~ area, ~~or~~ building that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.

~~Grocery store is a building that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.~~

Hotel ~~F~~unction ~~A~~rea is a hotel room or area such as a hotel ballroom, meeting room, exhibit hall or conference room, together with pre-function areas and other spaces ancillary to its function.

~~Housing, Public and Commons Areas is housing other than Occupancy Group I that are living quarters. Commons areas may include dining, reading, study, library or other community spaces and/or medical treatment or hospice facilities.~~

~~Multi-family: A multi-family building contains multiple dwelling units that share common walls and may also share common floors or ceilings (apartments).~~

~~Dormitory: A space in a building where group sleeping accommodations are provided in one room, or in a series of closely associated rooms, for persons not members of the same family group, under joint occupancy and single management, as in college dormitories or fraternity houses.~~

~~Senior housing: Is specifically for habitation by seniors, including but not limited to independent living quarters, and assisted living quarters.~~

Kitchen/~~F~~ood ~~P~~reparation is a room or area with cooking facilities ~~and~~/or an area where food is prepared.

Laboratory, Scientific is a ~~space or facility room or area~~ where research, experiments, and measurement in medical and physical sciences are performed requiring examination of fine details. The ~~space area~~ may include workbenches, countertops, scientific instruments, and associated floor spaces. Scientific laboratory does not refer to film, computer, and other laboratories where scientific experiments are not performed.

Laundry is a ~~place room or area primarily designed or used for where~~ laundering activities ~~occur~~.

Library ~~A~~rea is a ~~room or area primarily designed or used as a~~ repository for literary materials, such as books, periodicals, newspapers, pamphlets and prints, kept for reading or reference.

Reading ~~a~~Areas: Is a ~~library facility term describing room or~~ areas ~~within a prescribed building space in a~~ library containing tables, chairs, or desks for library patrons to use for the purpose of reading books and other reference documents. Library reading areas include reading, circulation, and checkout areas. Reading areas do not include private offices, meeting, photocopy, or other rooms not used specifically for reading by library patrons.

Stacks ~~A~~rea: Is a ~~room or area in a~~ library ~~facility term describing a with~~ large grouping of shelving sections ~~within a prescribed building space~~. Stack aisles include pedestrian paths located in stack areas. ~~Book stack aisle lighting is typically a central aisle luminaire distributing light to stack faces on both sides of an aisle.~~

Lobby;

Hotel: Is the contiguous ~~space area~~ in a hotel/motel between the main entrance and the front desk, including reception, waiting and seating areas.

Main ~~e~~Entry: Is the contiguous ~~space area~~ in buildings other than hotel/motel that is directly located by the main entrance of the building through which persons must pass, including ~~any ancillary~~ reception, waiting and seating areas.

Locker ~~or~~ ~~D~~dressing ~~r~~Room is a room or area for changing clothing, sometimes equipped with lockers.

Lounge ~~or~~ ~~R~~ecreation is a room ~~or area~~ used for leisure activities ~~which may be~~ associated with a restaurant or bar.

Mall is a roofed or covered common pedestrian area within a mall building that serves as access for two or more tenants.

Medical and eClinical Ceare Area is a non “I” occupancy room or area in a building that does not provide overnight patient care and that is used to provide physical and mental care through medical, dental, or psychological examination and treatment, including, but not limited to, laboratories and treatment spaces.

~~Medical buildings and clinics is a building where medical and clinical care is provided.~~

Museum is a space room or area in which the primary function is the care or exhibit of works of artistic, historical, or scientific value. A museum does not include a gallery or other place where art is for sale. A museum does not include a lobby, conference room, or other occupancies where the primary function is not the care or exhibit of works of artistic, historical, or scientific value.

Office Area is a room, area, or building of CBC Group B Occupancy other than restaurants.

~~Open Area is a warehouse facility term describing a large unobstructed area that is typically used for the handling and temporary storage of goods.~~

~~Parking gGarage Area is a covered building or structure for the purpose of parking vehicles, which consists of at least a roof over the parking area enclosed with walls on all sides. Parking garages may have fences, rails, partial walls, or other barriers in place of one or more walls. The structure has an entrance(s) and exit(s), and includes areas for vehicle maneuvering to reach the parking spaces. If the roof of a parking structure is also used for parking, the section without an overhead roof is considered a parking lot instead of a parking garage. Parking garages may include the following areas:~~

~~Daylight Transition Zone is the interior path of travel for vehicles to enter a parking garage as needed to transition from exterior daylight levels to interior light levels. Daylight Transition Zones only include the path of vehicular travel and do not include adjacent Parking Areas.~~

~~Dedicated Ramps are driveways specifically for the purpose of moving vehicles between floors of a parking garage and which have no adjacent parking. Dedicated ramps do not include sloping floors of a parking structure, which are considered Parking Areas.~~

~~Parking aAreas is are the areas of a pParking gGarage used only for the purpose of parking and maneuvering of vehicles on a single floor, Parking areas include sloping floors of a parking garage. Parking areas do not include Daylight Transition Zones, Dedicated Ramps, or and which is not the roof of a pParking structureGarage, which may be present in a Parking Garage.~~

~~Daylight Transition Zone in a Parking Garage is the interior path of travel for vehicles to enter a parking garage as needed to transition from exterior daylight levels to interior light levels. Daylight Transition Zones only include the path of vehicular travel and do not include adjacent Parking Areas.~~

~~Dedicated Ramps in Parking Garages are driveways specifically for the purpose of moving vehicles between floors of a parking garage and which have no adjacent parking. Dedicated ramps do not include sloping floors of a parking structure, which are considered Parking Areas.~~

~~Ramps and entries are driveways for the purpose of moving vehicles between floors of a parking garage. Parking entries are driveways for the purpose of vehicles entering into a parking garage.~~

~~Religious facility is a building in which the primary function is for an assembly of people to worship, Religious facilities do not include classroom, housing, or gymnasium buildings.~~

Religious wWorship Area is a room, or area, or building in which the primary function is for an assembly of people to worship. Religious worship does not include classrooms, offices, or other areas in which the primary function is not for an assembly of people to worship.

~~Restaurant is a room, area, or building that is a food establishment as defined in Section 27520 of the Health and Safety Code.~~

Restroom is a room or suite of rooms providing personal facilities such as toilets and washbasins.

Retail Mmerchandise Ssales Area is a room or area, or building in which the primary activity is the sale of merchandise.

~~School is a building or group of buildings that is used by an organization that provides instruction to students, which is predominately classroom buildings but may also include auditorium, gymnasium, kitchen, library, multi-purpose rooms, dining and cafeteria, student union, maintenance staff workroom, and small storage spaces.~~

Stairs is a series of steps providing passage for persons from one level of a building to another, including escalators.

Stairwell is a vertical shaft in which stairs are located.

Support ~~a~~Area is a room or area used as a passageway, utility room, storage space, or other type of space associated with or secondary to the function of an occupancy that is listed in these regulations.

Tenant ~~L~~ease ~~space~~Area is a portion of room or area in a building intended for lease for which a specific tenant is not identified at the time of permit application.

Theater, Area

Motion ~~p~~icture is an assembly room or area, a hall, or a building with tiers of rising seats or steps for the showing of motion pictures.

Performance is an assembly room or area, a hall, or a building with tiers of rising seats or steps for the viewing of dramatic performances, lectures, musical events and similar live performances.

Transportation ~~f~~unction Area is the ticketing area, waiting area, baggage handling areas, concourse, ~~or other areas not covered by primary functions in TABLE 146 C~~ in an airport terminal, bus or rail terminal or station, subway or transit station, or a marine terminal.

Videoconferencing ~~s~~tudio is a room with permanently installed videoconferencing cameras, audio equipment, and playback equipment for both audio-based and video-based two-way communication between local and remote sites.

Vocational ~~room~~Area is a room or area used to provide training in a special skill to be pursued as a trade.

Waiting ~~a~~Area is an area other than a hotel lobby or main entry lobby normally provided with seating and used for people waiting.

Wholesale ~~S~~howroom is a room or area where samples of merchandise are displayed.

OCCUPIABLE SPACE is any enclosed space inside the pressure boundary and intended for human activities, including, but not limited to, all habitable spaces, toilets, closets, halls, storage and utility areas, and laundry areas.

OPEN COOLING TOWER is an open, or direct contact, cooling tower which exposes water directly to the cooling atmosphere, thereby transferring the source heat load from the water directly to the air by a combination of heat and mass transfer.

~~**OPERABLE SHADING DEVICE** is a device at the interior or exterior of a building or integral with a fenestration product, which is capable of being operated, either manually or automatically, to adjust the amount of solar radiation admitted to the interior of the building.~~

ORIENTATION, CARDINAL is one of the four principal directional indicators, north, east, south, and west, which are marked on a compass. Also called cardinal directions.

ORIENTATION, EAST-FACING is oriented to within 45 degrees of true east, including 45°00'00" south of east (SE), but excluding 45°00'00" north of east (NE).

ORIENTATION, NORTH-FACING is oriented to within 45 degrees of true north, including 45°00'00" east of north (NE), but excluding 45°00'00" west of north (NW).

ORIENTATION, SOUTH-FACING is oriented to within 45 degrees of true south including 45°00'00" west of south (SW), but excluding 45°00'00" east of south (SE).

ORIENTATION, WEST-FACING is oriented to within 45 degrees of true west, including 45°00'00" north of due west (NW), but excluding 45°00'00" south of west (SW).

OUTDOOR AIR (Outside air) is air taken from outdoors and not previously circulated in the building.

OUTDOOR LIGHTING ~~definitions~~ is electrical lighting used to illuminate outdoor areas.

OUTDOOR AREAS are areas external to a building. These ~~include~~ include but are not limited to the following areas:

Building entrance way is the external area of any operable doorway in or out of a building, including overhead doors. ~~These areas serve A~~any doorway, set of doors (including elevator doors such as in parking garages), turnstile, vestibule, or other form of portal that is ordinarily used to gain access to the building by its users and occupants. Where buildings have separate one-way doors to enter and to leave, this also includes any area serving any doors ordinarily used to leave the building.

Building façade is the exterior surfaces of a building, not including horizontal roofing, signs, and surfaces not visible from any reasonable public accessible viewing location.

Canopy is a permanent structure, other than a parking garage area as defined in Section 101100.1, consisting of a roof and supporting building elements, with the area beneath at least partially open to the elements. A canopy may be freestanding or attached to surrounding structures. A canopy roof may serve as the floor of a structure above.

Carport is a covered, open-sided structure designed or used primarily solely for the purpose of parking vehicles, consisting having of a roof over the parking area. Typically, carports are free-standing or projected from the side of the building and are only two or fewer car lengths deep.

Hardscape is an improvement to a site that is paved or has other structural features, including but not limited to, curbs, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, water features and pools, storage or service yards, loading docks, amphitheaters, outdoor sales lots, and private monuments and statuary.

Landscape lighting is a type of outdoor lighting that is recessed into or mounted on the ground, paving, or raised deck, which is mounted less than 42" above grade or mounted onto trees or trellises, and that is intended to be aimed only at landscape features.

~~Lantern is an ornamental outdoor luminaire that uses an electric lamp to replicate a pre electric lantern, which used a flame to generate light.~~

~~Lighting zone is a geographic area designated by the California Energy Commission that determines requirements for outdoor lighting, including lighting power densities and specific control, equipment or performance requirements. Lighting zones are numbered LZ1, LZ2, LZ3, and LZ4.~~

~~Marquee lighting is a permanent lighting system consisting of one or more rows of many small lights, including light emitting diodes (LEDs), or fiber optic lighting, attached to a canopy.~~

~~Ornamental lighting is post top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting.~~

~~Outdoor lighting is all electrical lighting used to illuminate outdoor areas, including but not limited to lighting for parking lots, signs, building entrances, outdoor sales areas, outdoor canopies, landscape lighting, lighting for building facades and hardscape lighting.~~

Outdoor sales frontage is the portion of the perimeter of an outdoor sales area immediately adjacent to a street, road, or public sidewalk.

Outdoor sales lot is an uncovered paved area used exclusively for the display of vehicles, equipment or other merchandise for sale. All internal and adjacent access drives, walkway areas, employee and customer parking areas, vehicle service or storage areas are not outdoor sales lot areas, but are considered hardscape.

Parking lot is an uncovered area for the purpose of parking vehicles. Parking lot is a type of hardscape.

Paved area is an area that is paved with concrete, asphalt, stone, brick, gravel, or other improved wearing surface, including the curb.

~~Pendant is a mounting method in which the luminaire is suspended from above.~~

~~Post top luminaire is an ornamental outdoor luminaire that is mounted directly on top of a lamp post.~~

Principal viewing location is anywhere along the adjacent highway, street, road or sidewalk running parallel to an outdoor sales frontage.

Public monuments are statuary, buildings, structures, and/or hardscape on public land.

Sales canopy is a canopy specifically to cover and protect an outdoor sales area.

Stairways and ramps. Stairways are one or more flights of stairs with the necessary landings and platforms connecting them to form a continuous and uninterrupted passage from one level to another. An exterior stairway is open on at least one side, except for required structural columns, beams, handrails and guards. The adjoining open areas shall be either yards, courts or public ways. The other sides of the exterior stairway need not be open. Ramps are walking surfaces with a slope steeper than 5 percent.

Vehicle service station is a gasoline, natural gas, diesel, or other fuel dispensing station.

OUTDOOR LIGHTING ZONE is a geographic area designated by the California Energy Commission in accordance with Part 1, Section 10-114, that determines requirements for outdoor lighting, including lighting power densities and specific control, equipment or performance requirements. Lighting zones are numbered LZ1, LZ2, LZ3, and LZ4.

PERMANENTLY INSTALLED LIGHTING includes all luminaires attached to the inside or outside of a building or site, including track and flexible lighting system; lighting attached to walls, ceilings, columns, inside or outside of permanently installed cabinets, internally illuminated case work, mounted on poles, in trees, or in the ground; attached to ceiling fans and integral to exhaust fans that are other than exhaust hoods for cooking equipment. Permanently installed luminaires may have either plug-in or hardwired connections for electric power. Permanently installed lighting does not include portable lighting or lighting that is installed by the manufacturer in refrigerators, stoves, microwave ovens, exhaust hoods for cooking equipment, refrigerated cases, vending machines, food preparation equipment, and scientific and industrial equipment.

PART 1 means Part 1 of Title 24 of the California Code of Regulations.

PART 6 means Part 6 of Title 24 of the California Code of Regulations.

PART-LOAD OPERATION occurs when a loaded air compressor is operating below its maximum rated capacity.

PARTICLE SIZE EFFICIENCY is the fraction (percentage) of particles that are captured on air filter equipment as determined during rating tests conducted in accordance with ASHRAE Standard 52.2 or AHRI Standard 680. Particle Size Efficiency is measured in three particle size ranges: 0.3-1.0, 1.0-3.0, 3.0-10 microns.

PRIMARY STORAGE is compressed air storage located between the compressors and any dryers or other conditioning equipment.

POOLS, ANSI/NSPI-5 is the American National Standards Institute and National Spa and Pool Institute document entitled "American National Standard for Residential Inground Swimming Pools" 2003 (ANSI/NSPI-5 2003).

POOLS, AUXILIARY POOL LOADS are features or devices that circulate pool water in addition to that required for pool filtration, including, but not limited to, solar pool heating systems, filter backwashing, pool cleaners, waterfalls, fountains, and spas.

POOLS, BACKWASH VALVE is a diverter valve designed to backwash filters located between the circulation pump and the filter, including, but not limited to, slide, push-pull, multi-port, and full-flow valves.

POOLS, MULTI-SPEED PUMP is a pump capable of operating at two (2) or more speeds and includes two-speed and variable-speed pumps.

POOLS, NSF/ANSI 50 is the NSF International (formerly National Sanitation Foundation) Standard and American National Standards Institute document entitled "Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs" 2005 (NSF/ANSI 50 – 2005).

POOLS, RESIDENTIAL are permanently installed residential in-ground swimming pools intended for use by a single-family home for noncommercial purposes and with dimensions as defined in ANSI/NSPI-5.

PORTABLE LIGHTING is lighting with plug-in connections for electric power that is table and freestanding floor lamps, attached to modular furniture, workstation task lights, lights attached to workstation panels, movable displays, and other equipment that is not permanently installed lighting.

PRESSURE BOUNDARY is the primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to the outside than to the conditioned space would be considered outside the pressure boundary. Exposed earth in a crawlspace or basement shall not be considered part of the pressure boundary.

PRIMARY AIRFLOW is the airflow (cfm or L/s) supplied to the zone from the air-handling unit at which the outdoor air intake is located. It includes outdoor intake air and recirculated air from that air-handling unit but does not include air transferred or air recirculated to the zone by other means.

PROCESS is an activity or treatment that is not related to the space conditioning, lighting, service water heating, or ventilating of a building as it relates to human occupancy.

PROCESS BOILER is a boiler serving a process load.

~~**PROCESS SPACE** is a space that is thermostatically controlled to maintain a process environment temperature less than 55° F or to maintain a process environment temperature greater than 90° F for the whole space that the system serves, or that is a space with a space conditioning system designed and controlled to be incapable of operating at temperatures above 55° F or incapable of operating at temperatures below 90° F at design conditions.~~

~~**PROCESS, COVERED** are processes that are regulated under Part 6, which include but are not limited to computer rooms, laboratory exhaust, garage exhaust, commercial kitchen ventilation, refrigerator warehouses, supermarket refrigeration systems, compressed air systems, process cooling towers, process boilers.~~

~~**PROCESS, EXEMPT** is process that is not a covered process.~~

PROCESS LOAD is a load resulting from a process.

~~**PROCESS LOAD, COVERED** is a load resulting from a covered process.~~

~~**PROCESS LOAD, EXEMPT** is a load resulting from an exempt process.~~

~~**PROPOSED DESIGN BUILDING ENERGY USE** is the predicted energy use of proposed building derived from application of the building energy use modeling rules described in the Alternative Calculation Method (ACM) Approval Manual. In order for a building to comply with the standards, the energy use of the proposed design building energy use must be less than or equal to the energy use of the Standard Design Building and meet the mandatory requirements in the Title 24 Building Energy Efficiency Standards.~~

PUBLIC AREAS are spaces generally open to the public at large, customers or congregation members, or similar spaces where occupants need to be prevented from controlling lights for safety, security, or business reasons.

~~**R-VALUE** is the measure of the thermal resistance of insulation or any material or building component expressed in ft²-hr-°F/Btu.~~

~~**RADIANT BARRIER** is a highly reflective, low emitting material installed at the underside surface of the roof deck and the inside surface of gable ends or other exterior vertical surfaces in attics to reduce solar heat gain. ~~into the attic.~~~~

RAISED FLOOR is a floor (partition) over a crawl space, or an unconditioned space, or ambient air.

READILY ACCESSIBLE is capable of being reached quickly for operation, repair or inspection, without requiring climbing or removing obstacles, or resorting to access equipment.

RECOOL is the cooling of air that has been previously heated by space-conditioning equipment or systems serving the same building.

RECOVERED ENERGY is energy used in a building that (1) is recovered from space conditioning, service water heating, lighting, or process equipment after the energy has performed its original function; (2) provides space conditioning, service water heating, or lighting; and (3) would otherwise be wasted.

REFERENCE APPENDICES is the support document for the Building Energy Efficiency Standards and the ACM Approval Manuals. The document consists of three sections: the Reference Joint Appendices (JA), the Reference Residential Appendices (RA), and the Reference Nonresidential Appendices (NA).

REFLECTANCE, SOLAR is the ratio of the reflected solar flux to the incident solar flux.

REFRIGERATED CASE is a manufactured commercial refrigerator or freezer, including but not limited to display cases, reach-in cabinets, meat cases, and frozen food and soda fountain units.

REFRIGERATED WAREHOUSE is a building or a space greater than or equal to 3,000 square feet constructed for storage or handling of products, where mechanical refrigeration is used to maintain the space temperature at 55° F or less.

REFRIGERATED SPACE is ~~a building or~~ a space constructed for storage or handling of products, where mechanical refrigeration is used to maintain the space temperature at 55° F or less~~that is a refrigerated warehouse, walk-in cooler, or a freezer.~~

REHEAT is the heating of air that has been previously cooled by cooling equipment or supplied by an economizer.

RELATIVE SOLAR HEAT GAIN is the ratio of solar heat gain through a fenestration product (corrected for external shading) to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.

RELOCATABLE PUBLIC SCHOOL BUILDING is a relocatable building as defined by Title 24, Part 1, Section 4-314, which is subject to Title 24, Part 1, Chapter 4, Group 1.

REPAIR is the reconstruction or renewal for the purpose of maintenance of any component, system, or equipment of an existing building. Repairs shall not increase the preexisting energy consumption of the repaired component, system, or equipment. Replacement of any component, system, or equipment for which there are requirements in the Standards is considered an alteration and not a repair.

REPLACEMENT AIR is ~~outdoor or indoor~~ air that is used to replace air removed from a building through an exhaust system. Replacement air may be derived from one or more of the following: makeup air, portions of supply air, transfer air, or infiltration air. When replacement air exceeds exhaust, the result is exfiltration.

~~MAKEUP AIR is dedicated replacement air deliberately brought into the building from the outdoors and supplied to the vicinity of an exhaust hood to replace the air and cooking effluent being exhausted. Makeup air is generally filtered and fan forced, and it may be heated or cooled depending on the requirements of the application. Makeup air may be delivered through outlets integral to the exhaust hood (compensating hoods) or through outlets in the same room.~~

~~SUPPLY AIR is air entering a space from an air-conditioning, heating, or ventilating system for the purpose of comfort conditioning. Supply air is generally filtered, fan-forced, and heated, cooled, humidified or dehumidified as necessary to maintain specified temperature and humidity conditions. Only the quantity of outdoor air within the supply airflow contributes to replacement air.~~

~~TRANSFER AIR is air transferred, whether actively by fans or passively by pressure differentials, from one room to another within a building through openings in the room envelope.~~

~~INFILTRATION AIR is outdoor air that enters a building or space through openings in the building or space envelope due to negative pressure in the space or building relative to the exterior of the building envelope.~~

RESIDENTIAL BUILDING (See “high-rise residential building” and “low-rise residential building”)

RESIDENTIAL COMPLIANCE MANUAL is the manual developed by the Commission, under Section 25402.1 of the Public Resources Code, to aid designers, builders, and contractors in meeting Energy Efficiency Standards for low-rise residential buildings.

RESIDENTIAL SPACE TYPE is one of the following:

Bathroom is a room or area containing a sink used for personal hygiene, toilet, shower, or a tub.

Closet is a non-habitable room used for the storage of linens, household supplies, clothing, non-perishable food, or similar uses, and which is not a hallway or passageway.

Garage is a non-habitable building or portion of building, attached to or detached from a residential dwelling unit, in which motor vehicles are parked.

Kitchen is a room or area used for cooking, food storage and preparation and washing dishes, including associated counter tops and cabinets, refrigerator, stove, ovens, and floor area.

Laundry is a non-habitable room or space which contains plumbing and electrical connections for a washing machine or clothes dryer.

Storage building is a non-habitable detached building used for the storage of tools, garden equipment, or miscellaneous items.

Utility room is a non-habitable room or building which contains only HVAC, plumbing, or electrical controls or equipment; and which is not a bathroom, closet, garage, or laundry room.

ROOF is the outside cover of a building or structure including the structural supports, decking, and top layer that is exposed to the outside with a slope less than 60 degrees from the horizontal.

ROOF, LOW-SLOPED is a roof that has a ratio of rise to run of 2:12 or less (9.5 degrees from the horizontal).

ROOF, STEEP-SLOPED is a roof that has a ratio of rise to run of greater than 2:12 (9.5 degrees from the horizontal).

ROOFING PRODUCT is the top layer(s) of the roof that is exposed to the outside, which has properties including but not limited to solar reflectance, thermal emittance, and mass.

ROOF RECOVER BOARD is a rigid type board, typically 1/4 inch to 3/4 inch thick, installed directly below a low-sloped roof membrane, with or without above deck thermal insulation, to: (a) improve a roof system's compressive strength, ~~or to~~ (b) physically separate the roof membrane from the thermal insulation, or (c) physically separate a new roof covering from an underlying roof membrane as part of a roof overlay project.

RUNOUT is piping that is no more than 12 feet long and connects to a fixture or an individual terminal unit.

SATURATED CONDENSING TEMPERATURE (also known as CONDENSING TEMPERATURE) is: (a) for single component and azeotropic refrigerants, the saturation temperature corresponding to the refrigerant pressure at the condenser entrance, or (b) for zeotropic refrigerants, the arithmetic average of the Dew Point and Bubble Point temperatures corresponding to the refrigerant pressure at the condenser entrance.

SCIENTIFIC EQUIPMENT is measurement, testing or metering equipment used for scientific research or investigation, including but not limited to manufactured cabinets, carts and racks.

~~**SCONCE** is a wall-mounted ornamental luminaire.~~

SEASONAL ENERGY EFFICIENCY RATIO (SEER) is the total cooling output of an air conditioner in Btu during its normal usage period for cooling divided by the total electrical energy input in watt-hours during the same period, as determined using the applicable test method in the Appliance Efficiency Regulations.

~~**SERIES FAN POWERED TERMINAL UNIT** is a terminal unit that combines a VAV damper in series with a downstream fan which runs at all times that the terminal unit is supplying air to the space.~~

SERVICE WATER HEATING is heating of water for sanitary purposes for human occupancy, other than for comfort heating.

SHADING is the protection from heat gains because of direct solar radiation by permanently attached exterior devices or building elements, interior shading devices, glazing material, or adherent materials.

SHADING COEFFICIENT (SC) is the ratio of the solar heat gain through a fenestration product to the solar heat gain through an unshaded 1/8-inch-thick clear double strength glass under the same set of conditions. For nonresidential, high-rise residential, and hotel/motel buildings, this shall exclude the effects of mullions, frames, sashes, and interior and exterior shading devices.

SHOWER HEAD is a fixture for directing the spray of water in a shower. A shower head may incorporate one or more sprays, nozzles or openings. All components that are supplied standard together and function from one inlet (i.e., after the mixing valve) form a single shower head.

SIGN definitions include the following:

Electronic Message Center (EMC) is a pixilated image producing electronically controlled sign formed by any light source. Bare lamps used to create linear lighting animation sequences through the use of chaser circuits, also known as "chaser lights" are not considered an EMC.

Illuminated face is a side of a sign that has the message on it. For an exit sign it is the side that has the word "EXIT" on it.

Sign, cabinet is an internally illuminated sign consisting of frame and face(s), with a continuous translucent message panel, also referred to as a panel sign

Sign, channel letter is an internally illuminated sign with multiple components, each built in the shape of an individual three dimensional letters or symbol that are each independently illuminated, with a separate translucent panel over the light source for each element.

Sign, double-faced is a sign with two parallel opposing faces.

Sign, externally illuminated is any sign or a billboard that is lit by a light source that is external to the sign directed towards and shining on the face of the sign.

Sign, internally illuminated is a sign that is illuminated by a light source that is contained inside the sign where the message area is luminous, including cabinet signs and channel letter signs.

Sign, traffic is a sign for traffic direction, warning, and roadway identification.

Sign, unfiltered is a sign where the viewer perceives the light source directly as the message, without any colored filter between the viewer and the light source, including neon, cold cathode, and LED signs.

SINGLE PACKAGE VERTICAL AIR CONDITIONER (SPVAC): Is a type of air-cooled small or large commercial package air-conditioning and heating equipment; factory assembled as a single package having its major components arranged vertically, which is an encased combination of cooling and optional heating components; is intended for exterior mounting on, adjacent interior to, or through an outside wall; and is powered by single or three-phase current. It may contain separate indoor grille(s), outdoor louvers, various ventilation options, indoor free air discharge, ductwork, wall plenum, or sleeve. Heating components may include electrical resistance, steam, hot water, gas, or no heat but may not include reverse cycle refrigeration as a heating means.

SINGLE PACKAGE VERTICAL HEAT PUMP (SPVHP): Is an SPVAC that utilizes reverse cycle refrigeration as its primary heat source, with secondary supplemental heating by means of electrical resistance, steam, hot water, or gas.

SINGLE ZONE SYSTEM is an air distribution system that supplies air to one thermal zone.

~~**SITE BUILT FENESTRATION** is fenestration designed to be field glazed or field assembled units using specific factory cut or otherwise factory formed framing and glazing units that are manufactured with the intention of being assembled at the construction site and are provided with an NFRC label certificate for site built fenestration. Examples of site built fenestration include storefront systems, curtain walls, and atrium roof systems.~~

SITE SOLAR ENERGY is thermal, chemical, or electrical energy derived from direct conversion of incident solar radiation at the building site.

SKYLIGHT is fenestration installed on a roof less than 60 degrees from the horizontal.

SKYLIGHT AREA is the area of the rough opening for the skylight.

SKYLIGHT TYPE is one of the following three types of skylights: glass mounted on a curb, glass not mounted on a curb or plastic (assumed to be mounted on a curb).

SMACNA is the Sheet Metal and Air-Conditioning Contractors National Association.

~~**SMACNA HVAC DUCT CONSTRUCTION STANDARDS** is the Sheet Metal Contractors' National Association document "HVAC Duct Construction Standards Metal and Flexible - 3rd Edition," 2006 (2006ANSI/SMACNA-006-2006 HVAC Duct Construction Standards Metal and Flexible 3rd Edition)~~

SMACNA RESIDENTIAL COMFORT SYSTEM INSTALLATION STANDARDS MANUAL is the Sheet Metal Contractors' National Association document entitled "Residential Comfort System Installation Standards Manual, Seventh Edition." (1998).

SOCIAL SERVICES BUILDING is a space where public assistance and social services are provided to individuals or families.

~~**SOLAR HEAT GAIN COEFFICIENT (SHGC)** is the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.~~

~~**SOLAR HEAT GAIN COEFFICIENT, CENTER OF GLAZING (SHGCC)** is the SHGC for the center of glazing area.~~

~~**SOLAR HEAT GAIN COEFFICIENT, TOTAL FENESTRATION PRODUCT (SHGC OR SHGC_T)** is the SHGC for the total fenestration product.~~

SOLAR REFLECTANCE INDEX (SRI) is a measure of the roof's ability to reject solar heat which includes both reflectance and emittance.

SOLAR SAVINGS FRACTION (SSF) is the fraction of domestic hot water demand provided by a solar water-heating system.

SOLAR ZONE is a section of the roof designated and reserved for the future installation of a solar electric or solar thermal system.

SOUTH-FACING (See "orientation")

SPA is a vessel that contains heated water in which humans can immerse themselves, is not a pool, and is not a bathtub.

SPACE-CONDITIONING SYSTEM is a system that provides heating, or cooling within or associated with conditioned spaces in a building, that and may consist of but not limited to incorporate use of components such as chillers/compressors, fluid distribution systems (e.g., air ducts, water piping, refrigerant piping), pumps, air handlers, unit, cooling and heating coils, air and/or water cooled condensers, economizers, terminal units, and associated controls and the air distribution system, which provide either collectively or individually heating, ventilating, or cooling within or associated with conditioned spaces in a building.

New or Replacement Space Conditioning Systems installed as part of an addition or alteration include all of the system heating/cooling equipment (e.g. condensing unit and cooling or heating coil for split systems; or complete replacement of a package unit); and an entirely new or replacement duct system (see definition); and an entirely new or replacement air handler.

STANDARD DESIGN BUILDING is a building that complies with the mandatory and prescriptive requirements in the Title 24 Building Energy Efficiency Standards by using the building energy modeling rules described in the Alternative Calculation Method (ACM) Approval Manual.

STORAGE, COLD, is a storage area within a refrigerated warehouse where space temperatures are maintained at or above 32° F.

STORAGE, FROZEN is a storage area within a refrigerated warehouse where the space temperatures are maintained below 32° F.

~~**SYSTEM** is a combination of equipment, controls, accessories, interconnecting means, or terminal elements by which energy is transformed to perform a specific function, such as space conditioning, service water heating, or lighting; or an assembly of individual components when in aggregate provide a specific function and has specific thermal characteristics, such as a wall, roof, or floor.~~

~~**TASK LIGHTING** is lighting that is designed specifically to illuminate a task location, and that is generally confined to the task location.~~

~~**TEMPORARY LIGHTING** is a lighting installation with plug-in connections that does not persist beyond 60 consecutive days or more than 120 days per year.~~

TENANT SPACE is a portion of a building ~~intended for occup~~ied aney by a ~~single~~ tenant.

THERMAL MASS is solid or liquid material used to store heat for later heating use or for reducing cooling requirements.

THERMAL RESISTANCE (R) is a measurement of the resistance over time of a material or building component to the passage of heat in (hr x ft² x °F)/Btu.

THERMOSTATIC EXPANSION VALVE (TXV) is a refrigerant metering valve, installed in an air conditioner or heat pump, which controls the flow of liquid refrigerant entering the evaporator in response to the superheat of the gas leaving it.

THROW DISTANCE is the distance between the luminaire and the center of the plane lit by the luminaire on a display.

TIME DEPENDENT VALUATION (TDV) ENERGY is the time varying energy caused to be used by the building to provide space conditioning and water heating and for specified buildings lighting. TDV energy accounts for the energy

used at the building site and consumed in producing and in delivering energy to a site, including, but not limited to, power generation, transmission and distribution losses.

TOTAL HEAT OF REJECTION (THR) is the heat rejected by refrigeration system compressors at design conditions, consisting of the design cooling capacity plus the heat of compression added by the compressors.

TRANSFER AIR is air transferred, whether actively by fans or passively by pressure differentials, from one room to another within a building through openings in the room envelope

TRIM COMPRESSOR is a compressor that is designated for part-load operation, handling the short term variable trim load of end uses, in addition to the fully loaded base compressors.

U-FACTOR, ENVELOPE is the overall coefficient of thermal transmittance of a construction assembly, in Btu/(hr x ft² x °F), including air film resistance at both surfaces. **UL®** is the Underwriters Laboratories.

UL 181 is the Underwriters Laboratories document entitled “Standard for Factory-Made Air Ducts and Air Connectors,” 1996.

UL 181A is the Underwriters Laboratories document entitled “Standard for Closure Systems for Use With Rigid Air Ducts and Air Connectors,” 1994.

UL 181B is the Underwriters Laboratories document entitled “Standard for Closure Systems for Use With Flexible Air Ducts and Air Connectors,” 1995.

UL 723 is the Underwriters Laboratories document entitled “Standard for Test for Surface Burning Characteristics of Building Materials,” 1996.

UL 727 is the Underwriters Laboratories document entitled “Standard for Oil-Fired Central Furnaces,” 1994.

UL 731 is the Underwriters Laboratories document entitled “Standard for Oil-Fired Unit Heaters,” 1995.

UL 1574 is the Underwriters Laboratories document entitled “Track Lighting Systems,” 2000.

UL 1598 is the Underwriters Laboratories document entitled “Standard for Luminaires,” 2000.

UL 2108 is the Underwriters Laboratories document entitled “Low Voltage Lighting Systems,” 2008.

UNCONDITIONED SPACE is enclosed space within a building that is not directly conditioned, or indirectly conditioned.

UNIT INTERIOR MASS CAPACITY (UIMC) is the amount of effective heat capacity per unit of thermal mass, taking into account the type of mass material, thickness, specific heat, density and surface area.

VAPOR BARRIER-RETARDER CLASS is a material that has a permeance of one perm or less and that provides resistance to the transmission of water vapor. is a measure of the ability of a material or assembly to limit the amount of moisture that passes through the material or assembly meeting section 202 of the 2010 California Building Code.

VARIABLE AIR VOLUME (VAV) SYSTEM is a space-conditioning system that maintains comfort levels by varying the volume of supply air to the zones served.

VENDING MACHINE is a machine for vending and dispensing refrigerated or non-refrigerated food and beverages or general merchandise.

VERTICAL GLAZING (See “window”)

VERY VALUABLE MERCHANDISE is rare or precious objects, including, but not limited to, jewelry, coins, small art objects, crystal, ceramics, or silver, the selling of which involves customer inspection of very fine detail from outside of a locked case.

VISIBLE TRANSMITTANCE (VT) is the ratio (expressed as a decimal) of visible light that is transmitted through a glazing to the light that strikes the material as calculated in NFRC 200.

VISIBLE TRANSMITTANCE, CENTER OF GLAZING (VTC) is the VT for the center of glazing area.

VISIBLE TRANSMITTANCE, TOTAL FENESTRATION PRODUCT (VT OR VTT) is the VT for the total fenestration product.

WALL TYPE is a type of wall assembly having a specific heat capacity, framing type, and U-factor.

WATER BALANCE IN EVAPORATIVE COOLING TOWERS The water balance in cooling towers is:

$M = E + B + D$, where:

M = makeup water (from the mains water supply)

E = losses due to evaporation

B = losses due to blowdown

D = drift losses

WEST-FACING (See “orientation”)

WINDOW is fenestration that is not a skylight.

WINDOW AREA is the area of the surface of a window, plus the area of the frame, sash, and mullions.

WINDOW TYPE is a window assembly having a specific solar heat gain coefficient, relative solar heat gain, and U-factor.

WINDOW WALL RATIO is the ratio of the window area to the gross exterior wall area.

WOOD HEATER is an enclosed wood-burning appliance used for space heating and/or domestic water heating.

WOOD STOVE (See “wood heater”)

ZONE, CRITICAL is a zone serving a process where reset of the zone temperature setpoint during a demand shed event might disrupt the process, including but not limited to data centers, telecom and private branch exchange (PBX) rooms, and laboratories.

ZONE, NON-CRITICAL is a zone that is not a critical zone.

ZONE, SPACE-CONDITIONING, is a space or group of spaces within a building with sufficiently similar comfort conditioning requirements so that comfort conditions, as specified in Section 140.4(b)3 or 150.0(h), as applicable, can be maintained throughout the zone by a single controlling device.

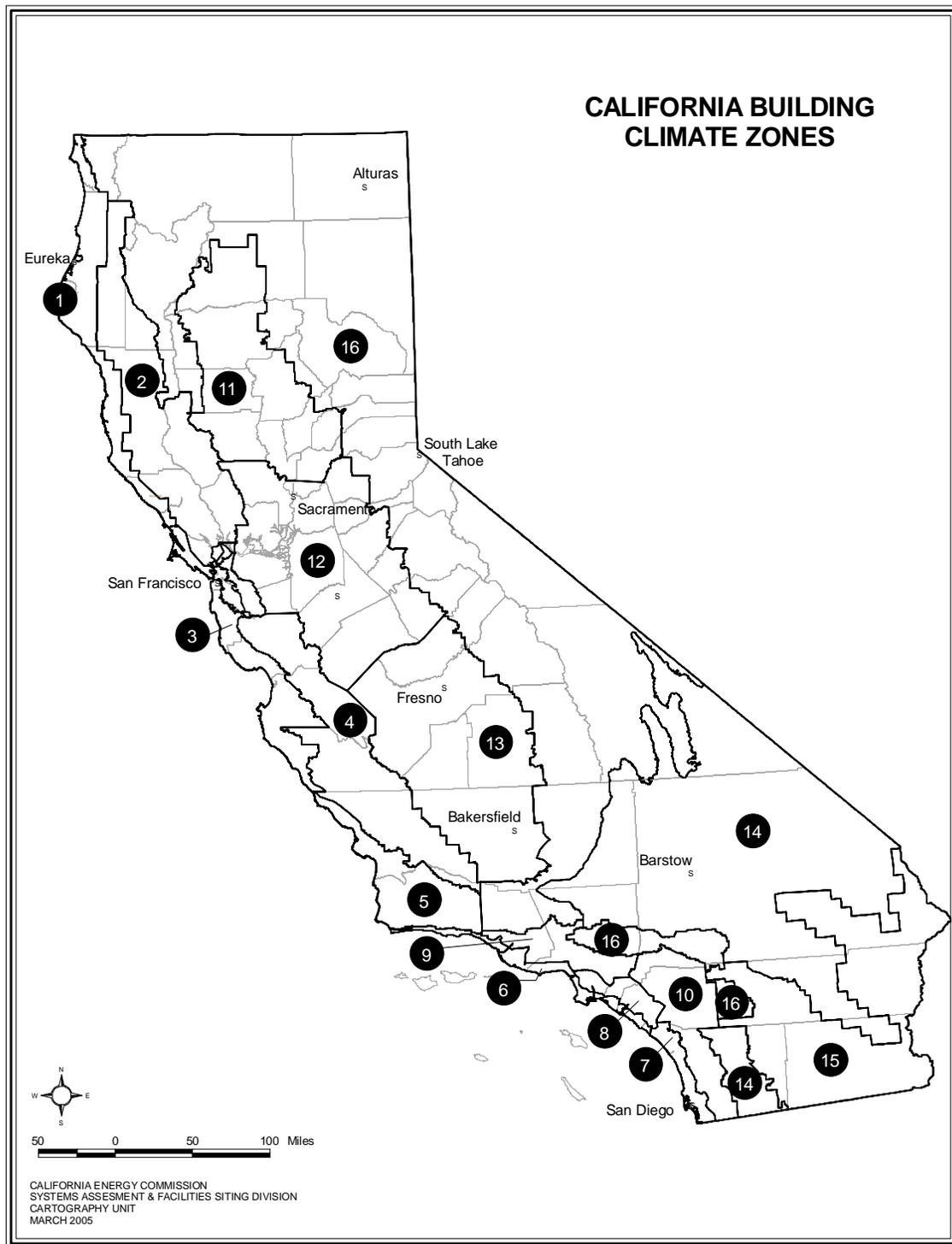


FIGURE 100.1-A—CALIFORNIA CLIMATE ZONES
Climate Zones for Residential and Nonresidential Occupancies

SECTION 100.2 – CALCULATION OF TIME DEPENDENT VALUATION (TDV) ENERGY

Time Dependent Valuation (TDV) energy shall be used to compare proposed designs to their energy budget when using the performance compliance approach. TDV energy is calculated by multiplying the site energy use (electricity kWh, natural gas therms, or fuel oil or LPG gallons) for each energy type times the applicable TDV multiplier. TDV multipliers vary for each hour of the year and by energy type (electricity, natural gas or propane), by climate zone and by building type (low-rise residential or nonresidential, high-rise residential or hotel/motel). TDV multipliers are summarized in Reference Joint Appendix JA3. TDV multipliers for propane shall be used for all energy obtained from depletable sources other than electricity and natural gas.

~~SECTION 103 – RESERVED.~~

~~SECTION 104 – RESERVED.~~

~~SECTION 105 – RESERVED.~~

~~SECTION 106 – RESERVED.~~

~~SECTION 107 – RESERVED.~~

~~SECTION 108 – RESERVED.~~

~~SECTION 109 – RESERVED.~~

110.0 to 110.5 All Mandatory Equipment

SUBCHAPTER 2

ALL OCCUPANCIES—MANDATORY REQUIREMENTS FOR THE MANUFACTURE, CONSTRUCTION AND INSTALLATION OF SYSTEMS, EQUIPMENT AND BUILDING COMPONENTS

SECTION 110.0 – SYSTEMS AND EQUIPMENT—GENERAL

Sections 110.1 through 110.9-10 establish requirements for manufacturing, construction, and installation of certain systems, equipment, appliances, and building components that are installed in buildings regulated by Title 24, Part 6.

Systems, equipment, appliances, and building components ~~listed below~~ may be installed in a building regulated by Part 6 only if:

- (a) The manufacturer has certified that the system, equipment, appliances, or building component complies with the applicable manufacturing provisions of Sections 110.1 through 110.9-10.
- (b) The system, equipment or building component complies with ~~the all~~ applicable installation provisions of Sections 110.1 through 110.9-10.

~~No system, equipment or building component covered by the provisions of Sections 111 through 119, that is not certified or that fails to comply with the applicable installation requirements, may be installed in a building regulated by Title 24, Part 6.~~

~~The systems, equipment and building components covered are:~~

~~Appliances regulated by the Appliance Efficiency Regulations (Section 111).~~

~~Other space-conditioning equipment (Section 112).~~

~~Other service water heating systems and equipment (Section 113).~~

~~Pool and spa systems and equipment (Section 114).~~

~~Gas appliances (Section 115).~~

~~Doors, windows, and fenestration products (Section 116).~~

~~Joints and other openings (Section 117).~~

~~Insulation and roofing products (Section 118).~~

~~Lighting control devices, ballasts, and luminaires (Section 119).~~

SECTION 110.1 – MANDATORY REQUIREMENTS FOR APPLIANCES REGULATED BY THE APPLIANCE EFFICIENCY REGULATIONS

- (a) ~~Any appliance for which there is a California standard established in the~~ regulated by the Appliance Efficiency Regulations, Title 20 California Code of Regulations, section 1601 et seq., may be installed only if Section 1608(a) is satisfied with respect to the manufacturer has certified to the Commission, as specified in those regulations, that the appliance complies with the applicable standard for that appliance.

For certified appliances, go to www.energy.ca.gov/appliances/database/.

- (b) Except for those circumstances described in Section 110.1(c), conformance with Part 6-specific efficiency requirements shall be verified utilizing data from either:
1. the Energy Commission's database of certified appliances maintained pursuant to 20 Cal. Code Regs., section 1606, and which is available at: www.energy.ca.gov/appliances/database/, or
 2. an equivalent directory published by a federal agency, or
 3. an approved trade association directory as defined in 20 Cal. Code Regs., Section 1606(h).
- (c) Conformance with Part 6-specific efficiency requirements may be demonstrated either by utilizing minimal efficiency values defined in Part 6 or by criteria approved by the Commission when:
1. data to verify conformance with Part 6-specific efficiency requirements is not available pursuant to subdivision (b), or
 2. field verification and diagnostic testing is required for compliance with Part 6 and there is not an applicable field verification and diagnostic test protocol available in Part 6 that is suitable to the appliance, or
 3. the appliance meets the requirements of 110.1(a) and has been site-modified in a way that affects its performance, or
 4. the system has received a waiver under 10 CFR 430.27 or 431.401 and that waiver fails to specify how the efficiency of the system shall be determined.

SECTION 110.2 – MANDATORY REQUIREMENTS FOR SPACE-CONDITIONING EQUIPMENT

Certification by Manufacturers. Any space-conditioning equipment listed in this section may be installed only if the manufacturer has certified that the equipment complies with all the applicable requirements of this section.

- (a) **Efficiency.** Equipment shall meet the applicable efficiency requirements in ~~TABLE 110.2-A~~~~TABLE 110.2-A~~~~TABLE 110.2-A~~~~TABLE 110.2-A~~ through ~~TABLE 110.2-G~~~~TABLE 110.2-M~~, subject to the following:
1. If more than one efficiency standard is listed for any equipment in ~~TABLE 110.2-A~~~~TABLE 110.2-A~~~~TABLE 110.2-A~~~~TABLE 110.2-A~~ through ~~TABLE 110.2-G~~~~TABLE 110.2-M~~, the equipment shall meet all the applicable standards that are listed; and
 2. If more than one test method is listed in ~~TABLE 110.2-A~~~~TABLE 110.2-A~~~~TABLE 110.2-A~~~~TABLE 110.2-A~~ through ~~TABLE 110.2-G~~~~TABLE 110.2-M~~, the equipment shall comply with the applicable efficiency standards when tested with each listed test method; and
 3. Where equipment can serve more than one function, such as both heating and cooling, or both space heating and water heating, it shall comply with all the efficiency standards requirements applicable to each function; and
 4. Where a requirement is for equipment rated at its "maximum rated capacity" or "minimum rated capacity," the capacity shall be as provided for and allowed by the controls, during steady-state operation.

EXCEPTION 1 to Section 110.2(a): Water-cooled centrifugal water-chilling packages that are not designed for operation at AHRI Standard 550/590 test conditions of 44°F leaving chilled water temperature and 85°F entering condenser water temperature with 3 gallons per minute per ton condenser water flow shall have a ~~minimum-maximum~~ full load ~~COP~~kW/ton and NPLV ratings adjusted using the following equation:

~~as shown in TABLE 110.2 H, TABLE 110.2 I, and TABLE 110.2 J, and a minimum NPLV rating as shown in TABLE 110.2 K, TABLE 110.2 L, and TABLE 110.2 M. The table values are only applicable over the following full load design ranges:~~

~~Leaving Chiller Water Temp. ————— 40 to 48°F~~

~~Entering Condenser Water Temp. — 75 to 85°F~~

~~Condensing Water Temp. Rise ————— 5 to 15°F~~

~~Adjusted maximum full-load kW/ton rating = (full-load kW/ton from Table 110.2-D) / Kadj~~

~~Adjusted maximum NPLV rating = (IPLV from Table 110.2-D) / Kadj~~

~~Where~~

~~Kadj = A * B~~

~~$A = 0.00000014592 * (\text{LIFT})^4 - 0.0000346496 * (\text{LIFT})^3 + 0.00314196 * (\text{LIFT})^2 - 0.147199 * (\text{LIFT}) + 3.9302$~~

~~LIFT = LvgCond – LvgEvap (°F)~~

~~LvgCond = Full-load leaving condenser fluid temperature (°F)~~

~~LvgEvap = Full-load leaving evaporator fluid temperature (°F)~~

~~$B = 0.0015 * \text{LvgEvap} + 0.934$~~

~~The adjusted full-load and NPLV values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:~~

- ~~• Minimum Leaving Evaporator Fluid Temperature: 36°F~~
- ~~• Maximum Leaving Condenser Fluid Temperature: 115°F~~
- ~~• LIFT > 20°F and < 80°F~~

~~Centrifugal chillers designed to operate outside of these ranges are not covered by this exception.~~

~~**EXCEPTION 2 to Section 110.2(a):** Positive displacement (air- and water-cooled) chillers with a leaving evaporator fluid temperature higher than 32°F, shall show compliance with Table 110.2D when tested or certified with water at standard rating conditions, per the referenced test procedure.~~

(b) **Controls for Heat Pumps with Supplementary Electric Resistance Heaters.** Heat pumps with supplementary electric resistance heaters shall have controls:

1. That prevent supplementary heater operation when the heating load can be met by the heat pump alone; and
2. In which the cut-on temperature for compression heating is higher than the cut-on temperature for supplementary heating, and the cut-off temperature for compression heating is higher than the cut-off temperature for supplementary heating.

EXCEPTION 1 to Section 110.2(b): The controls may allow supplementary heater operation during:

- A. Defrost; and
- B. Transient periods such as start-ups and following room thermostat setpoint advance, if the controls provide preferential rate control, intelligent recovery, staging, ramping or another control mechanism designed to preclude the unnecessary operation of supplementary heating.

~~(c)~~

~~Thermostats. All unitary heating and/or cooling systems including heat pumps that are not controlled by a central energy management control system (EMCS) shall have a setback thermostat.~~

- ~~1. **Setback Capabilities.** All thermostats shall have a clock mechanism that allows the building occupant to program the temperature set points for at least four periods within 24 hours. Thermostats for heat pumps shall meet the requirements of Section 112(b).~~

EXCEPTION to Section 112(c): Gravity gas wall heaters, gravity floor heaters, gravity room heaters, non-central electric heaters, fireplaces or decorative gas appliances, wood stoves, room air conditioners, and room air conditioner heat pumps need not comply with this requirement. Additionally, room air conditioner heat pumps need not comply with Section 112(b). Under performance method of compliance, the resulting increase in energy use due to elimination of the setback thermostat shall be factored into the compliance analysis in accordance with a method prescribed by the Executive Director.

(c) Thermostats. All unitary heating and/or cooling systems including heat pumps that are not controlled by a central energy management control system (EMCS) shall have an Upgradeable Setback Thermostat (UST) that is self-certified by the manufacturer to the Energy Commission to meet the requirements of Subsections 110.2(c)(1), 110.2(c)(2), and 110.2(c)3 below:

1. Setback Capabilities. All USTs shall have a clock mechanism that allows the building occupant to program the temperature set points for at least four periods within 24 hours. Thermostats for heat pumps shall meet the requirements of Section 110.2(b).
2. Upgradeable Capabilities. USTs shall not include onboard communication devices and shall have at least one expansion port which will allow for the installation of a removable module containing a radio or physical connection port to enable communication. The communications capabilities shall enable DEMAND RESPONSIVE CONTROL through receipt of DEMAND RESPONSE SIGNALS based on communications standards (including but not limited to ZigBee (IEEE 802.14.4) and/or WiFi (IEEE 802.11)) and standards based messaging protocols (Smart Energy Profile (SEP), OpenADR and/or others defined in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards (CoS)). Installation of the module shall upgrade the programmable setback thermostat to a communicating setback thermostat. After the communication module is installed and the occupant has enrolled in a DEMAND RESPONSE program or subscribed to receive demand response related messages or informational updates, the UST shall be capable of both receiving and responding to DEMAND RESPONSE SIGNALS. USTs, with the communication module installed, shall be capable of receiving and automatically responding to the DEMAND RESPONSE SIGNALS as follows:

A. Event Response.

- i. Upon initial installation of the communication module by the occupant, the UST shall default to offsets of +4°F for cooling and -4°F for heating relative to the current setpoint in response to DR events or pricing signals. The current setpoint is the setpoint that existed just prior to the current DR event.
- ii. The UST shall have the capability to allow occupants or their representative to modify the default offsets with user defined offsets for cooling and heating relative to the current setpoint in response to DR events and pricing signals.
- iii. Override Function: Occupants shall be able to change the offsets and thermostat settings or set points at any time, including during DR events.
- iv. A DEMAND RESPONSE SIGNAL shall trigger the UST to adjust the thermostat setpoint by either the default number of degrees or as established by the user.
- v. When a price signal indicates a price in excess of the price established by the user, the UST shall adjust the thermostat setpoint by either the default number of degrees or as established by the user.
- vi. The DEMAND RESPONSE SIGNAL shall start the DEMAND RESPONSE PERIOD either immediately or at a specific start time as specified in the event signal and continue for the DEMAND RESPONSE PERIOD specified in the DEMAND RESPONSE SIGNAL or until the occupant overrides the event set point.
- vii. The thermostat's price response shall start either immediately or at a specific start time as specified in the pricing signal and continue for the duration specified in the pricing signal or until the occupant overrides the event set point.
- viii. The UST shall have the capability to allow occupants to define setpoints for cooling and heating in response to DR and pricing signals as an alternative to temperature-offsetting response.

- ix. At the end of the DEMAND RESPONSE PERIOD, the thermostat set point shall be set to the set point that is programmed for the point in time that the event ends or to the manually established set point that existed just prior to the current DR event.
3. Other Required Capabilities. USTs shall also have the following capabilities, as further described in Reference Joint Appendix JA5:
- A. Physical Connections
- i. The expansion/communication port shall be readily accessible to the occupant for installing and removing the communication module.
- ii. The equipment interface for the UST to be connected to the HVAC system shall comply with industry standards as described in NEMA DC 3-2008 or subsequent revision of this specification.
- B. The capability to display information to the user regarding:
- i. communications system connection status.
- ii. an indication that a event DEMAND RESPONSE PERIOD or pricing event is in progress, and
- iii. other maintenance-related information.
- C. Unless the messaging protocol contains randomization or restoration delay logic, upgraded USTs shall employ restoration delay logic to randomly delay set point restoration for up to 30 minutes after being instructed to conclude or cancel a Demand Response Period. The specific maximum restoration delay for restoration after a Demand Response Period can be defined within the Demand Response Signal for that event. The display of the thermostat shall not indicate the end of the event until after the random delay.
- D. Include the capability to allow the occupant to restore the default temperature offsets and setpoints to levels specified in 110.2(c)2a.

EXCEPTION 1 to Section 110.2(c): Gravity gas wall heaters, gravity floor heaters, gravity room heaters, non-central electric heaters, fireplaces or decorative gas appliances, wood stoves, room air conditioners, and room air-conditioner heat pumps need not comply with this requirement. Additionally, room air-conditioner heat pumps need not comply with Section 110.2(b).

EXCEPTION 2 to Section 110.2(c): Other devices within the heating and cooling system capable of providing equivalent demand response functionality described in Section 110.2(c) that is approved by the Executive Director.

EXCEPTION 3 to Section 110.2(c): In existing buildings including new additions to existing buildings, or in newly constructed buildings where the owner occupant is known, the thermostat or HVAC control system installed may be equipped with onboard communication devices provided that they meet all other technical requirements in Section 110.2(c) and have the capability to turn off power to the onboard communication device and render it inoperative.

- (d) Gas- and Oil-Fired Furnace Standby Loss Controls.** Gas-fired and oil-fired forced air furnaces with input ratings $\geq 225,000$ Btu/h shall also have an intermittent ignition or interrupted device (IID), and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings $\geq 225,000$ Btu/h, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input rating.
- (e) Evaporative or Open Cooling Towers.** All evaporative or open cooling towers shall comply with the following:
1. Be equipped with Conductivity or Flow-based Controls that maximize cycles of concentration based on local water quality conditions. Controls shall automate system bleed and chemical feed based on conductivity, or in proportion to metered makeup volume, metered bleed volume, or bleed time. Conductivity controllers shall be installed in accordance with manufacturer's specifications.
 2. Documentation of Maximum Achievable Cycles of Concentration. Building owner shall document the maximum cycles of concentration based on local water supply as reported annually by the local water supplier, and using the Energy Commission-provided calculator. The calculator is intended to determine maximum cycles based on a Langelier Saturation Index (LSI) of 2.5 or less. Building owner shall document maximum cycles of concentration

on Compliance Form MECH 5C, which shall be reviewed and signed by the Professional Engineer (P.E.) of Record.

3. Be equipped with a Flow Meter on the makeup water line.
4. Be equipped with an Overflow Alarm to prevent overflow of the sump in case of makeup water valve failure. Overflow alarm shall send an audible signal or provide an alert via the Energy Management Control System to the tower operator in case of sump overflow.
5. Be equipped with Efficient Drift Eliminators that achieve drift reduction to 0.002% of the circulated water volume for counter-flow towers and 0.005% for cross-flow towers.

EXCEPTION to Section 110.2(e): Towers with rated capacity < 150 tons.

(f) Low Leakage Air-Handling Units. To qualify as a low leakage air-handling unit for use for determining compliance with the performance standards set forth in Section 150.1(b), the manufacturer shall certify to the Energy Commission that the air-handling unit meets the specifications in Reference Joint Appendix JA9.

TABLE 110.2-A ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Efficiency a		Test Procedurec
		Before 1/1/2015	After 1/1/2015	
Air conditioners, air cooled both split system and single package	> 65,000 Btu/h and < 135,000 Btu/h	11.2 EERb 11.4 IEERb	Applicable minimum efficiency values as determined by 20 California Code of Regulations (Title 20) section 1605.1.	AHRI 340/360
	> 135,000 Btu/h and < 240,000 Btu/h	11.0 EERb 11.2 IEERb		AHRI 340/360
	> 240,000 Btu/h and < 760,000 Btu/h	10.0 EERb 10.1 IEERb		
	> 760,000 Btu/h	9.7 EERb and 9.8 IEERb		
Air conditioners, water cooled	> 240,000 Btu/h and < 760,000 Btu/h	12.4 EERb 12.6 IEERb		AHRI 340/360
	> 760,000 Btu/h	12.2 EERb 12.4 IEERb		
Air conditioners, evaporatively cooled	> 240,000 Btu/h and < 760,000 Btu/h	11.9 EERb 12.1 IEERb		AHRI 340/360
	> 760,000 Btu/h	11.7 EERb 11.9 IEERb		
Condensing units, air cooled	> 135,000 Btu/h	10.5 EER 11.8 IEER		AHRI 365
Condensing units, water cooled	> 135,000 Btu/h	13.5 EER 14.0 IEER		
Condensing units, evaporatively cooled	> 135,000 Btu/h	13.5 EER 14.0 IEER		

a IEERs are only applicable to equipment with capacity modulation.

b Deduct 0.2 from the required EERs and IEERs for units with a heating section other than electric resistance heat.

c Applicable test procedure and reference year are provided under the definitions.

Equipment Type	Size Category	Efficiency a		Test Procedurec
		Before 1/1/2015	After 1/1/2015	
Air conditioners, air cooled both split system and single package	> 65,000 Btu/h and < 135,000 Btu/h	11.2 EERb 11.4 IEERb	Applicable minimum efficiency values as determined by 20 California Code of Regulations (Title 20) section 1605.1.	AHRI 340/360
	> 135,000 Btu/h and < 240,000 Btu/h	11.0 EERb 11.2 IEERb		AHRI 340/360
	> 240,000 Btu/h and < 760,000 Btu/h	10.0 EERb 10.1 IEERb		
	> 760,000 Btu/h	9.7 EERb and 9.8 IEERb		
Air conditioners, water cooled	> 240,000 Btu/h and < 760,000 Btu/h	12.4 EERb 12.6 IEERb		AHRI 340/360
	> 760,000 Btu/h	12.2 EERb 12.4 IEERb		
Air conditioners, evaporatively cooled	> 240,000 Btu/h and < 760,000 Btu/h	11.9 EERb 12.1 IEERb		AHRI 340/360
	> 760,000 Btu/h	11.7 EERb 11.9 IEERb		
Condensing units, air cooled	> 135,000 Btu/h	10.5 EER 11.8 IEER		AHRI 365
Condensing units, water cooled	> 135,000 Btu/h	13.5 EER 14.0 IEER		
Condensing units, evaporatively cooled	> 135,000 Btu/h	13.5 EER 14.0 IEER		

a IEERs are only applicable to equipment with capacity modulation.

b Deduct 0.2 from the required EERs and IEERs for units with a heating section other than electric resistance heat.

c Applicable test procedure and reference year are provided under the definitions.

Equipment Type	Size Category	Efficiency ^a		Test Procedure	
		Before 1/1/2015 ₀	After 1/1/2015 ₀		
Air Conditioners, Air Cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	11.0 10.23 EER ^b	11.72 EER ^b	ANSI/ARI 340/360	
	≥ 135,000 Btu/h and < 240,000 Btu/h	11.0 10.07 EER ^b	11.70 EER ^b		
	≥ 240,000 Btu/h and < 760,000 Btu/h	10.0 9.05 EER ^b and 9.7 IPLV ^b	10.0 EER ^b and 9.7 IPLV ^b		ANSI/ARI 340/360
	≥ 760,000 Btu/h	9.7 9.22 EER ^b and 9.4 IPLV ^b	9.7 EER ^b and 9.4 IPLV ^b		
Air Conditioners, Water and Evaporatively Cooled	> 240,000 Btu/h	11.0 11.0 EER ^b and 10.3 IPLV ^b		ANSI/ARI 210/240	
				ANSI/ARI 340/360	
Condensing Units, Air Cooled	≥ 135,000 Btu/h	10.1 EER and 11.2 IPLV		ANSI/ARI 365	
Condensing Units, Water or Evaporatively Cooled	≥ 135,000 Btu/h	13.1 EER and 13.1 IPLV			

^a IPLVs are only applicable to equipment with capacity modulation

^b Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

TABLE 110.2-B UNITARY AND APPLIED HEAT PUMPS, MINIMUM EFFICIENCY REQUIREMENTS

TABLE 110.2-B UNITARY AND APPLIED HEAT PUMPS, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Efficiency ^a		Test Procedure
			Before 1/1/2015 ₀	After 1/1/2015 ₀	
Air-Cooled (Cooling Mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	11.0 10.01 EER ^b	11.0	ANSI/ARI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h		10.0 10.63 EER ^b	10.6	
	≥ 240,000 Btu/h		9.50 EER ^b and 9.2 IPLV ^b	9.5 EER ^b and 9.2 IPLV ^b	
Air-Cooled (Heating Mode)	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling	47°F db/43°F wb Outdoor Air	3.32 COP	3.3 COP	ANSI/ARI 210/240

Capacity)
 ≥135,000 Btu/h 47°F db/43°F wb 3.21 COP 3.2 COP ANSI/ARI
 (Cooling Outdoor Air 340/360
 Capacity)

^a IPLVs and Part load rating conditions are applicable only to equipment with capacity modulation.

^b Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

Equipment Type	Size Category	Subcategory or Rating Condition	Efficiency a	Test Procedurec
Air Cooled (Cooling Mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	11.0 EERb 11.2 IEERb	AHRI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h		10.6 EERb 10.7 IEERb	
	> 240,000 Btu/h		9.5 EERb 9.6 IEERb	
Air Cooled (Heating Mode) Split system and single package	≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)	47° F db/43° F wb outdoor air	3.3 COP	AHRI 340/360
		17° F db/15° F wb outdoor air	2.25 COP	
	≥ 135,000 Btu/h (cooling capacity)	47° F db/43° F wb outdoor air	3.2 COP	
		17° F db/15° F wb outdoor air	2.05 COP	

a IEERs are only applicable to equipment with capacity modulation.

b Deduct 0.2 from the required EERs and IEERs for units with a heating section other than electric resistance heat.

c Applicable test procedure and reference year are provided under the definitions.

TABLE 110.2-C AIR-COOLED GAS-ENGINE HEAT PUMPS

Equipment Type	Size Category	Subcategory or Rating Condition	Efficiency ^a	Test Procedure
Air-Cooled Gas-Engine Heat Pump (Cooling Mode)	All Capacities	95° F db Outdoor Air	0.60 COP	ANSI Z21.40.4 ▲
Air-Cooled Gas-Engine Heat Pump (Heating Mode)	All Capacities	47° F db/43° F wb Outdoor Air	0.72 COP	ANSI Z21.40.4 ▲

TABLE 110.2-D WATER CHILLING PACKAGES – MINIMUM EFFICIENCY REQUIREMENTS ^{a,b}

<u>Equipment Type</u>	<u>Size Category</u>	<u>Path A Efficiency</u>	<u>Path B Efficiency</u>	<u>Test Procedure^c</u>
<u>Air Cooled, With Condenser Electrically Operated</u>	<u>< 150 Tons</u>	<u>≥ 9.562 EER</u> <u>≥ 12.500 IPLV</u>	<u>N.A.^d</u>	<u>AHRI 550/590</u>
	<u>≥ 150 Tons</u>	<u>≥ 9.562 EER</u> <u>≥ 12.750 IPLV</u>	<u>N.A.</u>	
<u>Air Cooled, Without Condenser Electrically Operated</u>	<u>All Capacities</u>	<u>Air-cooled chillers without condensers must be rated with matching condensers and comply with the air-cooled chiller efficiency requirements.</u>		
<u>Water Cooled, Electrically Operated, Reciprocating (Reciprocating)</u>	<u>All Capacities</u>	<u>Reciprocating units must comply with the water-cooled positive displacement efficiency requirements.</u>		<u>AHRI 550/590</u>
<u>Water Cooled, Electrically Operated Positive Displacement</u>	<u>< 75 Tons</u>	<u>≤ 0.780 kW/ton</u> <u>≤ 0.630 IPLV</u>	<u>≤ 0.800 kW/ton</u> <u>≤ 0.600 IPLV</u>	<u>AHRI 550/590</u>
	<u>≥ 75 tons and < 150 tons</u>	<u>≤ 0.775 kW/ton</u> <u>≤ 0.615 IPLV</u>	<u>≤ 0.790 kW/ton</u> <u>≤ 0.586 IPLV</u>	
	<u>≥ 150 tons and < 300 tons</u>	<u>≤ 0.680 kW/ton</u> <u>≤ 0.580 IPLV</u>	<u>≤ 0.718 kW/ton</u> <u>≤ 0.540 IPLV</u>	
	<u>≥ 300 Tons</u>	<u>≤ 0.620 kW/ton</u> <u>≤ 0.540 IPLV</u>	<u>≤ 0.639 kW/ton</u> <u>≤ 0.490 IPLV</u>	
<u>Water Cooled, Electrically Operated, Centrifugal</u>	<u>< 150 Tons</u>	<u>≤ 0.634 kW/ton</u> <u>≤ 0.596 IPLV</u>	<u>≤ 0.639 kW/ton</u> <u>≤ 0.450 IPLV</u>	
	<u>≥ 150 tons and < 300 tons</u>	<u>≤ 0.634 kW/ton</u> <u>≤ 0.596 IPLV</u>	<u>≤ 0.639 kW/ton</u> <u>≤ 0.450 IPLV</u>	
	<u>≥ 300 tons and < 600 tons</u>	<u>≤ 0.576 kW/ton</u> <u>≤ 0.549 IPLV</u>	<u>≤ 0.600 kW/ton</u> <u>≤ 0.400 IPLV</u>	
	<u>≥ 600 Tons</u>	<u>≤ 0.570 kW/ton</u> <u>≤ 0.539 IPLV</u>	<u>≤ 0.590 kW/ton</u> <u>≤ 0.400 IPLV</u>	
<u>Air Cooled Absorption, Single Effect</u>	<u>All Capacities</u>	<u>≥ 0.600 COP</u>	<u>N.A.</u>	<u>ANSI/AHRI 560</u>
<u>Water Cooled Absorption, Single Effect</u>	<u>All Capacities</u>	<u>≥ 0.700 COP</u>	<u>N.A.</u>	
<u>Absorption Double Effect, Indirect-Fired</u>	<u>All Capacities</u>	<u>≥ 1.000 COP</u> <u>≥ 1.050 IPLV</u>	<u>N.A.</u>	
<u>Absorption Double Effect, Direct-Fired</u>	<u>All Capacities</u>	<u>≥ 1.000 COP</u> <u>≥ 1.000 IPLV</u>	<u>N.A.</u>	
<u>Water Cooled Gas Engine Driven Chiller</u>	<u>All Capacities</u>	<u>≥ 1.2 COP</u> <u>≥ 2.0 IPLV</u>	<u>N.A.</u>	<u>ANSI Z21.40.4A</u>

Table Footnotes:

~~a~~ ~~a~~—No requirements for:

- ~~Centrifugal chillers with designed chilled water supply temperature < 36 F, or~~
- ~~Positive displacement chillers with designed chilled water supply temperature < 32F, or~~
- ~~Absorption chillers with designed chilled water supply temperature < 40F~~

~~b~~ ~~b~~—Must meet the minimum requirements of Path A or Path B. However, both the full load (COP) and IPLV must be met to fulfill the requirements of the applicable~~either~~ Path.

~~c~~ ~~e~~—See section 100.1 for definitions

~~d~~ ~~d~~—NA means not applicable

~~e~~ ~~e~~—NR means no minimum requirement in this field.

TABLE 112-E PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Efficiency a		Test Procedure b
			Before 10/08/2012	After 10/08/2012	
PTAC (Cooling mode) New construction	All Capacities	95°F db Outdoor Air	12.5 - (0.213 x Cap/1000)a EER	13.8 - (0.300 x Cap/1000)a EER	ARI 310/380
PTAC (Cooling mode) Replacementsb	All Capacities	95°F db Outdoor Air	10.9 - (0.213 x Cap/1000)a EER	10.9 - (0.213 x Cap/1000)a EER	
PTHP (Cooling mode) New construction	All Capacities	95°F db Outdoor Air	12.3 - (0.213 x Cap/1000)a EER	14.0 - (0.300 x Cap/1000)a EER	
PTHP (Cooling mode) Replacementsb	All Capacities	95°F db Outdoor Air	10.8 - (0.213 x Cap/1000)a EER	10.8 - (0.213 x Cap/1000)a EER	
PTHP (Heating Mode) New Construction	All Capacities	=	3.2 - (0.026 x Cap/1000)a COP	3.7 - (0.052 x Cap/1000)a COP	
PTHP (Heating mode) Replacementsb	All Capacities	=	2.9 - (0.026 x Cap/1000)a COP	2.9 - (0.026 x Cap/1000)a COP	
SPVAC (Cooling Mode)	<65,000 Btu/h	95°F db / 75°F wb Outdoor Air	9.0 EER	9.0 EER	ARI 390
	≥65,000 Btu/h and <135,000 Btu/h	95°F db / 75°F wb Outdoor Air	8.9 EER	8.9 EER	
	≥135,000 Btu/h and <240,000 Btu/h	95°F db / 75°F wb Outdoor Air	8.6 EER	8.6 EER	
SPVHP (Cooling Mode)	<65,000 Btu/h	95°F db / 75°F wb Outdoor Air	9.0 EER	9.0 EER	
	≥65,000 Btu/h and <135,000 Btu/h	95°F db / 75°F wb Outdoor Air	8.9 EER	8.9 EER	
	≥135,000 Btu/h and <240,000 Btu/h	95°F db / 75°F wb Outdoor Air	8.6 EER	8.6 EER	
SPVHP (Heating Mode)	<65,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.0 COP	3.0 COP	
	≥65,000 Btu/h and <135,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.0 COP	3.0 COP	
	≥135,000 Btu/h and <240,000 Btu/h	47°F db / 43°F wb Outdoor Air	2.9 COP	2.9 COP	

a Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches high and less than 42 inches wide.

b Applicable test procedure and reference year are provided under the definitions

TABLE 110.2-E PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Efficiency*	Test Procedure
PTAC (Cooling Mode) New Construction	All Capacities	95°F db Outdoor Air	12.5 – (0.213 x Cap/1000)* EER	ANSI/ARI/CSA 310/380
PTAC (Cooling Mode) Replacements	All Capacities	95°F db Outdoor Air	10.9 – (0.213 x Cap/1000)* EER	

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Mode)			
Replacements ^b			
PTHP (Cooling Mode)			12.3 – (0.213 x Cap/1000) ^a EER
New Construction			
PTHP (Cooling Mode)			10.8 – (0.213 x Cap/1000) ^a EER
Replacements ^b			
PTHP (Heating Mode)			3.2 – (0.026 x Cap/1000) ^a COP
New Construction			
PTHP (Heating Mode)			2.9 – (0.026 x Cap/1000) ^a COP
Replacements ^b			
SPVAC (Cooling Mode)	< 65,000 Btu/h		9.0 EER
	≥ 65,000 Btu/h and < 135,000 Btu/h		8.9 EER
	≥ 135,000 Btu/h and < 240,000 Btu/h		8.6 EER
SPVHP (Cooling Mode)	< 65,000 Btu/h	95°F db / 75°F wb Outdoor Air	9.0 EER
	≥ 65,000 Btu/h and < 135,000 Btu/h		8.9 EER
	≥ 135,000 Btu/h and < 240,000 Btu/h		8.6 EER
SPVHP (Heating Mode)	< 65,000 Btu/h		3.0 COP
	≥ 65,000 Btu/h and < 135,000 Btu/h	47°F db / 43°F wb Outdoor Air	3.0 COP
	≥ 135,000 Btu/h and < 240,000 Btu/h		2.9 COP

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^a Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

^b Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches high and less than 42 inches wide.

110.2-F HEAT TRANSFER EQUIPMENT

Equipment Type	Subcategory	Minimum Efficiency ^a	Test Procedure ^b
Liquid-to-liquid heat exchangers	Plate type	NR	AHRI 400

^a NR = no requirement

^b Applicable test procedure and reference year are provided under the definitions

TABLE 110.2-G PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT^d

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition	Performance Required ^{a-b}	Test Procedure ^c
Propeller or Axial Fan Open Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F wb Outdoor Air	≥ 38.2 gpm/hp	CTI-ATC-105 and CTI-STD-201
Centrifugal Fan Open Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F wb Outdoor Air	≥ 20.0 gpm/hp	CTI-ATC-105 and CTI-STD-201
<u>Propeller or Axial Fan Open Cooling Towers</u>	<u>All</u>	<u>102°F Entering Water</u> <u>90°F Leaving Water</u> <u>75°F wb Outdoor Air</u>	<u>≥ 14.0 gpm/hp</u>	<u>CTI-ATC-105S(96)</u> <u>and</u> <u>CTI-STD-201</u>
<u>Centrifugal Fan Open Cooling Towers</u>	<u>All</u>	<u>102°F Entering Water</u> <u>90°F Leaving Water</u> <u>75°F wb Outdoor Air</u>	<u>≥ 7.0 gpm/hp</u>	<u>CTI-ATC-105S(96)</u> <u>and</u> <u>CTI-STD-201</u>
Air Cooled Condensers	<u>All-All</u>	125°F Condensing Temperature R22 Test Fluid 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering Drybulb	≥ 176,000 Btu/h•hp	<u>ANSI/ARI-460</u>

^a For purposes of this table, open cooling tower performance is defined as the maximum flow rating of the tower divided by the fan nameplate rated motor power.

^b For purposes of this table air cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power.

^c Open cooling towers shall be tested using the test procedures in CTI-ATC-105. Performance of factory assembled open cooling towers shall be either certified as base models as specified in CTI-STD-201 or verified by testing in the field by a CTI approved testing agency. Open factory assembled cooling towers with custom options added to a CTI certified base model for the purpose of safe maintenance or to reduce environmental or noise impact shall be rated at 90% of the CTI certified performance of the associated base model or at the manufacturer's stated performance, whichever is less. Base models of open factory assembled cooling towers are open cooling towers configured in exact accordance with the Data of Record submitted to CTI as specified by CTI-STD-201. There are no certification requirements for field erected cooling towers.

^d The efficiencies for open cooling towers listed in Table 110.2-G are not applicable for closed circuit cooling towers.

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition	Performance Required .a .b. c. d	Test Procedure e
Propeller or axial fan Open-circuit cooling towers	All	95°F entering water 85°F leaving water 75 °F entering air wb	> 38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal fan Open-circuit cooling towers	All	95°F entering water 85°F leaving water 75 °F entering air wb	> 20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Propeller or axial fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75 °F entering air wb	> 14.0 gpm/hp	CTI ATC-105S and CTI STD-201
Centrifugal fan closed-circuit cooling towers	All	95°F entering water 85°F leaving water 75 °F entering air wb	> 7.0 gpm/hp	CTI ATC-105S and CTI STD-201
Air cooled condensers	All	125°F condensing temperature R22 test fluid 190°F entering gas temperature 15°F subcooling 95°F entering drybulb	> 176,000 Btu/h-hp	ARI 460

a For purposes of this table, open-circuit cooling tower performance is defined as the water flow rating of the tower at the given rated conditions divided by the fan motor nameplate power.

b For purposes of this table, closed-circuit cooling tower performance is defined as the process water flow rating of the tower at the given rated conditions divided by the sum of the fan motor nameplate rated power and the integral spray pump motor nameplate power.

c For purposes of this table air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan motor nameplate power.

d Open cooling towers shall be tested using the test procedures in CTI ATC-105. Performance of factory assembled open cooling towers shall be either certified as base models as specified in CTI STD-201 or verified by testing in the field by a CTI approved testing agency. Open factory assembled cooling towers with custom options added to a CTI certified base model for the purpose of safe maintenance or to reduce environmental or noise impact shall be rated at 90% of the CTI certified performance of the associated base model or at the manufacturer's stated performance, whichever is less. Base models of open factory assembled cooling towers are open cooling towers configured in exact accordance with the Data of Record submitted to CTI as specified by CTI STD-201. There are no certification requirements for field erected cooling towers.

e Applicable test procedure and reference year are provided under the definitions.

TABLE 110.2-H COPS FOR NON-STANDARD CENTRIFUGAL CHILLERS < 150 TONS

Centrifugal Chillers < 150 Tons									
COP _{std} = 5.0									
			Condenser Flow Rate						
			2-gpm/ton	2.5-gpm/ton	3-gpm/ton	4-gpm/ton	5-gpm/ton	6-gpm/ton	
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ^a (°F)	Required COP						
46	75	29	5.58	5.83	6.03	6.32	6.54	6.70	
45	75	30	5.50	5.74	5.92	6.19	6.38	6.53	
44	75	31	5.42	5.65	5.82	6.07	6.24	6.37	
43	75	32	5.35	5.57	5.72	5.95	6.11	6.23	
42	75	33	5.27	5.49	5.64	5.85	6.00	6.11	
41	75	34	5.19	5.41	5.56	5.75	5.89	5.99	
46	80	34	5.19	5.41	5.56	5.75	5.89	5.99	
40	75	35	5.11	5.33	5.48	5.67	5.79	5.88	
45	80	35	5.11	5.33	5.48	5.67	5.79	5.88	
44	80	36	5.03	5.26	5.40	5.58	5.70	5.79	
43	80	37	4.94	5.18	5.32	5.50	5.62	5.70	
42	80	38	4.84	5.10	5.25	5.43	5.53	5.61	
41	80	39	4.73	5.01	5.17	5.35	5.46	5.53	
46	85	39	4.73	5.01	5.17	5.35	5.46	5.53	
40	80	40	4.62	4.92	5.09	5.27	5.38	5.45	
45	85	40	4.62	4.92	5.09	5.27	5.38	5.45	
44	85	41	4.49	4.82	5.00	5.20	5.30	5.38	
43	85	42	4.35	4.71	4.91	5.12	5.23	5.30	
42	85	43	4.19	4.59	4.81	5.03	5.15	5.22	
41	85	44	4.02	4.46	4.70	4.94	5.06	5.14	
40	85	45	3.84	4.32	4.58	4.84	4.98	5.06	
Condenser DT ^b			14.04	11.23	9.36	7.02	5.62	4.68	

^a LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)

^b Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

$$K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$$

–where X = Condenser DT + LIFT

$$COP_{adj} = K_{adj} * COP_{std}$$

TABLE 110.2-I COPS FOR NON-STANDARD CENTRIFUGAL CHILLERS > 150 TONS, ≤ 300 TONS

Centrifugal Chillers > 150 Tons, ≤ 300 Tons

COP_{std} = 5.55

Condenser Flow Rate						
2-gpm/ton	2.5-gpm/ton	3-gpm/ton	4-gpm/ton	5-gpm/ton	6-gpm/ton	

Leaving Chilled-Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ^a (°F)	Required COP					
			6.80	7.11	7.35	7.71	7.97	8.16
46	75	29	6.80	7.11	7.35	7.71	7.97	8.16
45	75	30	6.71	6.99	7.21	7.55	7.78	7.96
44	75	31	6.61	6.89	7.09	7.40	7.61	7.77
43	75	32	6.52	6.79	6.98	7.26	7.45	7.60
42	75	33	6.43	6.69	6.87	7.13	7.31	7.44
41	75	34	6.33	6.60	6.77	7.02	7.18	7.30
46	80	34	6.33	6.60	6.77	7.02	7.18	7.30
40	75	35	6.23	6.50	6.68	6.91	7.06	7.17
45	80	35	6.23	6.50	6.68	6.91	7.06	7.17
44	80	36	6.13	6.41	6.58	6.81	6.95	7.05
43	80	37	6.02	6.31	6.49	6.71	6.85	6.94
42	80	38	5.90	6.21	6.40	6.61	6.75	6.84
41	80	39	5.77	6.11	6.30	6.52	6.65	6.74
46	85	39	5.77	6.11	6.30	6.52	6.65	6.74
40	80	40	5.63	6.00	6.20	6.43	6.56	6.65
45	85	40	5.63	6.00	6.20	6.43	6.56	6.65
44	85	41	5.47	5.87	6.10	6.33	6.47	6.55
43	85	42	5.30	5.74	5.98	6.24	6.37	6.46
42	85	43	5.11	5.60	5.86	6.13	6.28	6.37
41	85	44	4.90	5.44	5.72	6.02	6.17	6.27
40	85	45	4.68	5.26	5.58	5.90	6.07	6.17
Condenser DT ^b			14.04	11.23	9.36	7.02	5.62	4.68

^a LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)

^b Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

$$K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$$

—where X = Condenser DT + LIFT

$$COP_{adj} = K_{adj} * COP_{std}$$

TABLE 110.2-K IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS < 150 TONS

			Centrifugal Chillers < 150 Tons					
			IPLV _{std} = 5.25					
			Condenser Flow Rate					
Leaving Chilled-Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ^a (°F)	2-gpm/ton	2.5-gpm/ton	3-gpm/ton	4-gpm/ton	5-gpm/ton	6-gpm/ton
			Required IPLV/NPLV					

46	75	29	5.84	6.10	6.30	6.61	6.84	7.00
45	75	30	5.75	6.00	6.19	6.47	6.68	6.83
44	75	31	5.67	5.91	6.08	6.34	6.53	6.67
43	75	32	5.59	5.82	5.99	6.23	6.39	6.52
42	75	33	5.51	5.74	5.90	6.12	6.27	6.39
41	75	34	5.43	5.66	5.81	6.02	6.16	6.26
46	80	34	5.43	5.66	5.81	6.02	6.16	6.26
40	75	35	5.35	5.58	5.73	5.93	6.06	6.15
45	80	35	5.35	5.58	5.73	5.93	6.06	6.15
44	80	36	5.26	5.50	5.65	5.84	5.96	6.05
43	80	37	5.16	5.42	5.57	5.76	5.87	5.96
42	80	38	5.06	5.33	5.49	5.67	5.79	5.87
41	80	39	4.95	5.24	5.41	5.60	5.71	5.78
46	85	39	4.95	5.24	5.41	5.60	5.71	5.78
40	80	40	4.83	5.14	5.32	5.52	5.63	5.70
45	85	40	4.83	5.14	5.32	5.52	5.63	5.70
44	85	41	4.69	5.04	5.25 ^e	5.43	5.55	5.62
43	85	42	4.55	4.93	5.13	5.35	5.47	5.54
42	85	43	4.38	4.80	5.03	5.26	5.38	5.46
41	85	44	4.21	4.67	4.91	5.17	5.30	5.38
40	85	45	4.01	4.52	4.79	5.06	5.20	5.29
Condenser DT ^b			14.04	11.23	9.36	7.02	5.62	4.68

^a LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)

^b Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

^e All values shown are NPLV except at conditions of 3 gpm/ton and 41 °F LIFT which is IPLV.

$$K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$$

—where X = Condenser DT + LIFT

$$COP_{adj} = K_{adj} * COP_{std}$$

TABLE 110.2-L IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS > 150 TONS, < 300 TONS

			Centrifugal Chillers > 150 Tons, < 300 Tons					
			IPLV _{std} = 5.9					
			Condenser Flow Rate					
			2-gpm/ton	2.5-gpm/ton	3-gpm/ton	4-gpm/ton	5-gpm/ton	6-gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ^a (°F)	Required IPLV/NPLV					

46	75	29	6.58	6.87	7.11	7.46	7.71	7.90
45	75	30	6.49	6.76	6.98	7.30	7.53	7.70
44	75	31	6.40	6.66	6.86	7.15	7.36	7.52
43	75	32	6.31	6.56	6.75	7.02	7.21	7.35
42	75	33	6.22	6.47	6.65	6.90	7.07	7.20
41	75	34	6.13	6.38	6.55	6.79	6.95	7.06
46	80	34	6.13	6.38	6.55	6.79	6.95	7.06
40	75	35	6.03	6.29	6.46	6.68	6.83	6.94
45	80	35	6.03	6.29	6.46	6.68	6.83	6.94
44	80	36	5.93	6.20	6.37	6.58	6.72	6.82
43	80	37	5.82	6.11	6.28	6.49	6.62	6.72
42	80	38	5.71	6.01	6.19	6.40	6.53	6.62
41	80	39	5.58	5.91	6.10	6.31	6.44	6.52
46	85	39	5.58	5.91	6.10	6.31	6.44	6.52
40	80	40	5.44	5.80	6.00	6.22	6.35	6.43
45	85	40	5.44	5.80	6.00	6.22	6.35	6.43
44	85	41	5.29	5.68	5.90 ^a	6.13	6.26	6.34
43	85	42	5.13	5.55	5.79	6.03	6.16	6.25
42	85	43	4.94	5.41	5.67	5.93	6.07	6.16
41	85	44	4.74	5.26	5.54	5.82	5.97	6.07
40	85	45	4.52	5.09	5.40	5.71	5.87	5.97
Condenser DT ^b			14.04	11.23	9.36	7.02	5.62	4.68

^a LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)

^b Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

^c All values shown are NPLV except at conditions of 3 gpm/ton and 41 °F LIFT which is IPLV.

$$K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$$

—where X = Condenser DT + LIFT

$$COP_{adj} = K_{adj} * COP_{std}$$

TABLE 110.2-M IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS > 300 TONS

			Centrifugal Chillers > 300 Tons					
			IPLV _{std} = 6.4					
			Condenser Flow Rate					
			2-gpm/ton	2.5-gpm/ton	3-gpm/ton	4-gpm/ton	5-gpm/ton	6-gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ^a (°F)	Required IPLV/NPLV					

46	75	29	7.15	7.47	7.72	8.10	8.37	8.58
45	75	30	7.05	7.35	7.58	7.93	8.18	8.36
44	75	31	6.95	7.23	7.45	7.77	8.00	8.16
43	75	32	6.85	7.13	7.33	7.63	7.83	7.98
42	75	33	6.75	7.03	7.22	7.49	7.68	7.82
41	75	34	6.65	6.93	7.12	7.37	7.55	7.67
46	80	34	6.65	6.93	7.12	7.37	7.55	7.67
40	75	35	6.55	6.83	7.01	7.26	7.42	7.54
45	80	35	6.55	6.83	7.01	7.26	7.42	7.54
44	80	36	6.44	6.73	6.92	7.15	7.30	7.41
43	80	37	6.32	6.63	6.82	7.05	7.19	7.30
42	80	38	6.20	6.53	6.72	6.95	7.09	7.19
41	80	39	6.06	6.42	6.62	6.85	6.99	7.08
46	85	39	6.06	6.42	6.62	6.85	6.99	7.08
40	80	40	5.91	6.30	6.52	6.76	6.89	6.98
45	85	40	5.91	6.30	6.52	6.76	6.89	6.98
44	85	41	5.75	6.17	6.40 ^a	6.66	6.79	6.89
43	85	42	5.57	6.03	6.28	6.55	6.70	6.79
42	85	43	5.37	5.88	6.16	6.44	6.59	6.69
41	85	44	5.15	5.71	6.01	6.33	6.49	6.59
40	85	45	4.91	5.53	5.86	6.20	6.37	6.48
Condenser DT ^b			14.04	11.23	9.36	7.02	5.62	4.68

^a LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)

^b Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

^c All values shown are NPLV except at conditions of 3 gpm/ton and 41 °F LIFT which is IPLV.

$$K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$$

—where X = Condenser DT + LIFT

$$COP_{adj} = K_{adj} * COP_{std}$$

SECTION 110.3 – MANDATORY REQUIREMENTS FOR SERVICE WATER-HEATING SYSTEMS AND EQUIPMENT

(a) Certification by Manufacturers. Any service water-heating system or equipment may be installed only if the manufacturer has certified that the system or equipment complies with all of the requirements of this subsection for that system or equipment.

1. Temperature controls for service water-heating systems. Service water-heating systems shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable temperature settings for the intended use as listed in Table 2, Chapter 9 of the ASHRAE Handbook, HVAC Applications Volume.

EXCEPTION to Section 110.3(a)1: Residential occupancies.

(b) **Efficiency.** Equipment shall meet the applicable requirements of the Appliance Efficiency Regulations as required by Section 110.1, subject to the following:

1. If more than one standard is listed in the Appliance Efficiency Regulations, the equipment shall meet all the standards listed; and

2. If more than one test method is listed in the Appliance Efficiency Regulations, the equipment shall comply with the applicable standard when tested with each test method; and
3. Where equipment can serve more than one function, such as both heating and cooling, or both space heating and water heating, it shall comply with all the requirements applicable to each function; and
4. Where a requirement is for equipment rated at its "maximum rated capacity" or "minimum rated capacity," the capacity shall be as provided for and allowed by the controls, during steady-state operation.

NOTE: The Building Energy Efficiency Standards use the term tankless water heater whereas the Appliance Efficiency Regulations use the term instantaneous water heater to refer to the same category of equipment.

(c) **Installation.** Any service water-heating system or equipment may be installed only if the system or equipment complies with all of the applicable requirements of this subsection for the system or equipment.

1. Outlet temperature controls. On systems that have a total capacity greater than 167,000 Btu/hr, outlets that require higher than service water temperatures as listed in the ASHRAE Handbook, Applications Volume, shall have separate remote heaters, heat exchangers, or boosters to supply the outlet with the higher temperature.
2. Controls for hot water distribution systems. Service hot water systems with circulating pumps or with electrical heat trace systems shall be capable of automatically turning off the system.

EXCEPTION to Section 113(e)2: Water heating systems serving a single dwelling unit.

3. **Temperature controls for public lavatories.** The controls shall limit the outlet temperature to 110°F.
4. **Insulation.** Unfired service water heater storage tanks and backup tanks for solar water-heating systems shall have:
 - A. External insulation with an installed R-value of at least R-12; or
 - B. Internal and external insulation with a combined R-value of at least R-16; or
 - C. The heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btu per hour per square foot.
5. **Water Heating Recirculation Loops Serving Multiple Dwelling Units, High-Rise Residential, Hotel/Motel and Nonresidential Occupancies.** A water heating recirculation loop is a type of hot water distribution system that reduces the time needed to deliver hot water to fixtures that are distant from the water heater, boiler or other water heating equipment. The recirculation loop is comprised of a supply portion, connected to branches that serve multiple dwelling units, guest rooms, or fixtures and a return portion that completes the loop back to the water heating equipment. A water heating recirculation loop shall meet the following requirements:
 - A. **Air release valve or vertical pump installation.** An automatic air release valve shall be installed on the recirculation loop piping on the inlet side of the recirculation pump and no more than 4 feet from the pump. This valve shall be mounted on top of a vertical riser at least 12" in length and shall be accessible for replacement and repair. Alternatively, the pump shall be installed on a vertical section of the return line.
 - B. **Recirculation loop backflow prevention.** A check valve or similar device shall be located between the recirculation pump and the water heating equipment to prevent water from flowing backwards through the recirculation loop.
 - C. **Equipment for pump priming.** A hose bibb shall be installed between the pump and the water heating equipment. An isolation valve shall be installed between the hose bibb and the water heating equipment. This hose bibb is used for bleeding air out of the pump after pump replacement.
 - D. **Pump isolation valves.** Isolation valves shall be installed on both sides of the pump. These valves may be part of the flange that attaches the pump to the pipe. One of the isolation valves may be the same isolation valve as in item C.
 - E. **Cold water supply and recirculation loop connection to hot water storage tank.** Storage water heaters and boilers shall be plumbed in accordance with the boiler manufacturer's specifications. The cold water piping and the recirculation loop piping shall not be connected to the hot water storage tank drain port.

- F. **Cold water supply backflow prevention.** A check valve shall be installed on the cold water supply line between the hot water system and the next closest tee on the cold water supply line. The system shall comply with the expansion tank requirements as described in the California Plumbing Code Section 608.3.
6. **Service water heaters in state buildings.** Any newly constructed building constructed by the State shall derive its service water heating from a system that provides at least 60 percent of the energy needed for service water heating from site solar energy or recovered energy.

EXCEPTION to Section 110.3(c)6: Buildings for which the state architect determines that service water heating from site solar energy or recovered energy is economically or physically infeasible.

7. Shower Heads. A single shower head must be installed directly on each pipe that terminates at a shower. Shower heads must be placed no closer than four feet from each other, as measured directly from one shower head to the next. Shower heads must have a rated flow rate of no more than 2.0 gallons per minute at 80 psi. Each mixing valve must supply only one shower head. The piping connecting the shower head to the heater or recirculation loop must be no wider than 1/2 inch at any point.

EXCEPTION to Section 110.3(c)7: Showers that recirculate hot water from the drain to the shower head.

SECTION 110.4 – MANDATORY REQUIREMENTS FOR POOL AND SPA SYSTEMS AND EQUIPMENT

- (a) Certification by Manufacturers. Any pool or spa heating system or equipment may be installed only if the manufacturer has certified that the system or equipment has all of the following:
1. Efficiency. A thermal efficiency that complies with the Appliance Efficiency Regulations; and
 2. On-off switch. A readily accessible on-off switch, mounted on the outside of the heater that allows shutting off the heater without adjusting the thermostat setting; and
 3. Instructions. A permanent, easily readable, and weatherproof plate or card that gives instruction for the energy efficient operation of the pool or spa heater and for the proper care of pool or spa water when a cover is used; and
 4. Electric resistance heating. No electric resistance heating; and

EXCEPTION 1 to Section 110.4(a)4: Listed package units with fully insulated enclosures, and with tight-fitting covers that are insulated to at least R-6.

EXCEPTION 2 to Section 110.4(a)4: Pools or spas deriving at least 60 percent of the annual heating energy from site solar energy or recovered energy.

- (b) Installation. Any pool or spa system or equipment shall be installed with all of the following:
1. Piping. At least 36 inches of pipe shall be installed between the filter and the heater or dedicated suction and return lines, or built-in or built-up connections shall be installed to allow for the future addition of solar heating equipment; and
 2. Covers. A cover for outdoor pools or outdoor spas that have a heat pump or gas heater.
 3. Directional inlets and time switches for pools. If the system or equipment is for a pool:
 - i. The pool shall have directional inlets that adequately mix the pool water; and
 - ii. A time switch or similar control mechanism shall be installed as part of the pool water circulation control system that will allow all pumps to be set or programmed to run only during the off-peak electric demand period and for the minimum time necessary to maintain the water in the condition required by applicable public health standards.

SECTION 110.5 – NATURAL GAS CENTRAL FURNACES, COOKING EQUIPMENT, AND POOL AND SPA HEATERS: PILOT LIGHTS PROHIBITED

Any natural gas system or equipment listed below may be installed only if it does not have a continuously burning pilot light:

- (a) Fan-type central furnaces.
- (b) Household cooking appliances.

EXCEPTION to Section 110.5(b): Household cooking appliances without an electrical supply voltage connection and in which each pilot consumes less than 150 Btu/hr.

- (c) Pool heaters.
- (d) Spa heaters.

110.6 through 110.8 All Mandatory Envelopes

SECTION 110.6 – MANDATORY REQUIREMENTS FOR FENESTRATION PRODUCTS AND EXTERIOR DOORS

(a) **Certification of Fenestration Products and Exterior Doors other than Field-fabricated.** Any fenestration product and exterior door, other than field-fabricated fenestration products and field-fabricated exterior doors, may be installed only if the manufacturer has certified to the Commission, or if an independent certifying organization approved by the Commission has certified, that the product complies with all of the applicable requirements of this subsection.

1. **Air leakage.** Manufactured fenestration products and exterior doors shall have air infiltration rates not exceeding 0.3 cfm/ft² of window area, 0.3 cfm/ft² of door area for residential doors, 0.3 cfm/ft² of door area for nonresidential single doors (swinging and sliding), and 1.0 cfm/ft² for nonresidential double doors (swinging), when tested according to NFRC-400 or ASTM E283 at a pressure differential of 75 pascals (or 1.57 pounds/ft²), incorporated herein by reference.

EXCEPTION to Section 110.6(a)1: Field-fabricated fenestration and field-fabricated exterior doors.

2. **U-factor.** ~~A~~The fenestration product's U-factor shall be rated in accordance with NFRC 100, or use the applicable default U-factor set forth in ~~TABLE 110.6-A~~TABLE 110.6-A.

EXCEPTION 1 to Section 110.6(a)2: If the fenestration product is a skylight or is a vertical site-built fenestration product in a building covered by the nonresidential standards with less than 10,000 square feet of site-built fenestration, the default U-factor may be calculated as set forth in Reference Nonresidential Appendix NA6.

EXCEPTION 2 to Section 110.6(a)2: If the fenestration product is an alteration consisting only of replacement glass in a building covered by the nonresidential standards, the default U-factor may be calculated as set forth in Reference Nonresidential Appendix NA6.

3. **Solar Heat Gain Coefficient-SHGC.** ~~The~~A fenestration product's SHGC shall be rated in accordance with NFRC 200 ~~for site-built fenestration~~, or use the applicable default SHGC set forth in ~~TABLE 110.6-B~~TABLE 110.6-B.

EXCEPTION 1 to Section 110.6(a)3: If the fenestration product is a skylight or is a vertical site-built fenestration product in a building covered by the nonresidential standards with less than 1,000 square feet of site-built fenestration, the default SHGC may be calculated as set forth in Reference Nonresidential Appendix NA6.

EXCEPTION 2 to Section 110.6(a)3: If the fenestration product is an alteration consisting only of replacement glass in a building covered by the nonresidential standards, the default SHGC may be calculated as set forth in Reference Nonresidential Appendix NA6.

4. **Visual Transmittance-VT.** The fenestration product's VT shall be rated in accordance with NFRC 200 or ASTM E972.

EXCEPTION 1 to Section 110.6(a)4: If the fenestration product is a skylight or is a vertical site-built fenestration product in a building covered by the nonresidential standards with less than 10,000 square feet of

site-built fenestration, the default SHGC-VT may be calculated using Reference Nonresidential Appendix NA6 as set forth in Reference Nonresidential Appendix NA6.

EXCEPTION 2 to Section 116(a)4: If the fenestration product is an alteration consisting only of replacement glass in a skylight or in a vertical site-built fenestration product, in a building covered by the nonresidential standards, the default VT may be calculated using Reference Nonresidential Appendix NA6.

4.5. Labeling. Fenestration products shall:

- A. Have a temporary label for manufactured fenestration products (or a label certificate for Component Modeling Approach (CMA) and site-built fenestration) meeting the requirements of Section 10-111(a)1. ~~label shall not be removed before inspection by the enforcement agency. The label, and which listing sing~~ the certified U-factor, ~~and~~ SHGC and VT, ~~shall not be removed before inspection by the enforcement agency. The, and temporary label shall~~ certifying that the air leakage requirements of Section 110.6(a)1 are met for each product line; and
- B. Have a permanent label or a ~~(or a~~ label certificate ~~for for~~ site-built fenestration) meeting the requirements of Section 10-111(a)2 if the product is rated using NFRC procedures.

5.6. Fenestration Acceptance Requirements. Before an occupancy permit is granted, site-built fenestration products in other ~~then than~~ low-rise residential buildings shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7 to ensure that site-built fenestration meet Standards requirements, including a matching label certificate for each product installed and be readily accessible at the project location. A Certificate of Acceptance ~~certifying that the fenestration product meets the acceptance requirements~~ shall be ~~completed, signed and~~ submitted to the enforcement agency. ~~that certifies that the fenestration product meets the acceptance requirements.~~

EXCEPTION to Section 110.6(a): Fenestration products removed and reinstalled as part of a building alteration or addition.

(b) **Installation of Field-fabricated Fenestration and Exterior Doors.** Field-fabricated fenestration and field-fabricated exterior doors may be installed only if the compliance documentation has demonstrated compliance for the installation using U-factors from ~~TABLE 110.6-A~~ ~~TABLE 110.6-A~~ and SHGC values from ~~TABLE 110.6-B~~ ~~TABLE 110.6-B~~. Field-fabricated fenestration and field-fabricated exterior doors shall be caulked between the fenestration products or exterior door and the building, and shall be weatherstripped.

EXCEPTION to Section 110.6(b): Unframed glass doors and fire doors need not be weatherstripped or caulked.

TABLE 110.6-A DEFAULT FENESTRATION PRODUCT U-FACTORS

FRAME	PRODUCT TYPE	SINGLE PANE ³ U-FACTOR	DOUBLE PANE ^{1,3} U-FACTOR	GLASS BLOCK ^{2,3} U-FACTOR
Metal	Operable	1.28	0.79	0.87
	Fixed	1.19	0.71	0.72
	Greenhouse/garden window	2.26	1.40	N.A.
	Doors	1.25	0.77	N.A.
	Skylight	1.98	1.30	N.A.
Metal, Thermal Break	Operable	N.A.	0.66	N.A.
	Fixed	N.A.	0.55	N.A.
	Greenhouse/garden window	N.A.	1.12	N.A.
	Doors	N.A.	0.59	N.A.

	Skylight	N.A.	1.11	N.A.
Nonmetal	Operable	0.99	0.58	0.60
	Fixed	1.04	0.55	0.57
	Doors	0.99	0.53	N.A.
	Greenhouse/garden windows	1.94	1.06	N.A.
	Skylight	1.47	0.84	N.A.

1. ~~_____~~ For all dual-glazed fenestration products, adjust the listed U-factors as follows:
 - a. ~~_____~~ Add 0.05 for products with dividers between panes if spacer is less than 7/16 inch wide.
 - b. ~~_____~~ Add 0.05 to any product with true divided lite (dividers through the panes).
2. ~~—TT~~ Translucent or transparent panels shall use glass block values when nonrated by NFRC 200.
3. Visual Transmittance (VT) shall be calculated by using Reference Nonresidential Appendix NA6.

TABLE 110.6-B - DEFAULT SOLAR HEAT GAIN COEFFICIENT (SHGC)

FRAME TYPE	PRODUCT	GLAZING	TOTAL WINDOW FENESTRATION PRODUCT SHGC		
			Single Pane ²	Double Pane ²	Glass Block ^{1,2}
Metal	Operable	Clear	0.80	0.70	0.70
	Fixed	Clear	0.83	0.73	0.73
	Operable	Tinted	0.67	0.59	N.A.
	Fixed	Tinted	0.68	0.60	N.A.
Metal, Thermal Break	Operable	Clear	N.A.	0.63	N.A.
	Fixed	Clear	N.A.	0.69	N.A.
	Operable	Tinted	N.A.	0.53	N.A.
	Fixed	Tinted	N.A.	0.57	N.A.
Nonmetal	Operable	Clear	0.74	0.65	0.70
	Fixed	Clear	0.76	0.67	0.67
	Operable	Tinted	0.60	0.53	N.A.
	Fixed	Tinted	0.63	0.55	N.A.

1. The SHGC for ~~TT~~ translucent or transparent panels shall be determined using values for glass blocks when such panels are not rated by NFRC 200. ~~Translucent or transparent panels shall use glass block values.~~
2. Visual Transmittance (VT) shall be calculated by using Reference Nonresidential Appendix NA6.

SECTION 110.7 – MANDATORY REQUIREMENTS ~~FOR TO LIMIT AIR LEAKAGE JOINTS AND OTHER OPENINGS~~

All ~~joints, and penetrations and~~ other openings in the building envelope that are potential sources of air leakage shall be caulked, gasketed, weather stripped, or otherwise sealed to limit infiltration and exfiltration.

SECTION 110.8 – MANDATORY REQUIREMENTS FOR INSULATION, ~~AND ROOFING PRODUCTS~~ AND RADIANT BARRIERS

- (a) **Insulation Certification by Manufacturers.** Any insulation shall be certified by Department of Consumer Affairs, Bureau of Home Furnishing and Thermal Insulation that the insulation conductive thermal performance is approved pursuant to the California Code of Regulations, Title 24, Part 12, Chapters 12-13, Article 3, “Standards for Insulating Material.”
- (b) **Installation of Urea Formaldehyde Foam Insulation.** Urea formaldehyde foam insulation may be applied or installed only if:
1. It is installed in exterior side walls; and
 2. A four-mil-thick plastic polyethylene vapor ~~barrier-retarder~~ or equivalent plastic sheathing vapor ~~barrier-retarder~~ is installed between the urea formaldehyde foam insulation and the interior space in all applications.
- (c) **Flame spread Rating of Insulation.** All insulating material shall be installed in compliance with the flame spread rating and smoke density requirements of the CBC.
- (d) **Installation of Insulation in Existing Buildings.** Insulation installed in an existing attic, or on an existing duct or water heater, shall comply with the applicable requirements of subsections 1, 2, and 3 below. If a contractor installs the insulation, the contractor shall certify to the customer, in writing, that the insulation meets the applicable requirements of subsections 1, 2, and 3 below.
1. **Attics.** If insulation is installed in the existing attic of a low-rise residential building, the R-value of the total amount of insulation (after addition of insulation to the amount, if any, already in the attic) shall ~~be at least R-38 in climate zones 1 and 16; and R-30 in all other climate zones~~ meet the requirements of Section 150.0(a).
EXCEPTION to Section 110.8(d)1: Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 1203.2 of Title 24, Part 2.
 2. **Water heaters.** If external insulation is installed on an existing unfired water storage tank or on an existing back-up tank for a solar water-heating system, it shall have an R-value of at least R-12, or the heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btu per hour per square foot.
 3. **Ducts.** If insulation is installed on an existing space-conditioning duct, it shall comply with Section 605 of the CMC.
- (e) **Insulation Placement ~~on of #Roof/Ceiling~~ insulation.** Insulation installed to limit heat loss and gain through the top of conditioned spaces shall comply with the following:
1. Insulation shall be installed in direct contact with a continuous roof or ceiling which is sealed to limit infiltration and exfiltration as specified in Section 110.7, including but not limited to placing insulation either above or below the roof deck or on top of a drywall ceiling; and
 2. When insulation is installed at the roof in nonresidential buildings, fixed vents or openings to the outdoors or to unconditioned spaces shall not be installed and the space between the ceiling and the roof is either directly or indirectly conditioned space and shall not be considered an attic for the purposes of complying with CBC attic ventilation requirements; and

3. Insulation ~~shall not be~~ placed on top of a suspended ceiling with removable ceiling panels ~~-to meet the Roof/Ceiling insulation requirement of Sections 120.7, 140.3 and 141.0 shall be deemed to have no affect on envelope heat loss;~~ and

EXCEPTION to Section 110.8(e) 3: When there are conditioned spaces with a combined floor area no greater than 2,000 square feet in an otherwise unconditioned building, and when the average height of the space between the ceiling and the roof over these spaces is greater than 12 feet, insulation placed in direct contact with a suspended ceiling with removable ceiling panels shall be an acceptable method of reducing heat loss from a conditioned space and shall be accounted for in heat loss calculations.

4. Insulation shall be installed below the roofing membrane or layer used to seal the roof from water penetration unless the insulation has a maximum water absorption of 0.3 percent by volume when tested according to ASTM Standard C272.

NOTE: Vents, which do not penetrate the roof deck, that are designed for wind resistance for roof membranes are not within the scope of Section 110.8(e)2.

- (f) **Insulation for Demising Walls in Nonresidential Buildings.** The opaque portions of framed demising walls in nonresidential buildings shall be insulated with an installed R-value of no less than R-13 between framing members.
- (g) **Insulation Requirements for Heated Slab Floors.** Heated slab-on-grade floors shall be insulated according to the requirements in ~~TABLE 110.8-TABLE 118-AB~~.
1. Insulation materials in ground contact must:
 - A. Comply with the certification requirements of Section 110.8(a); and
 - B. Have a water absorption rate for the insulation material alone without facings that are no greater than 0.3 percent when tested in accordance with Test Method A – 24 Hour-Immersion of ASTM C272.
 2. Insulation installation must:
 - A. Cover the insulation with a solid guard that protects against damage from ultraviolet radiation, moisture, landscaping operation, equipment maintenance, and wind; and
 - B. Include a rigid plate, which penetrates the slab and blocks the insulation from acting as a conduit for insects from the ground to the structure above the foundation.
- (h) **Wet Insulation Systems.** When insulation is installed on roofs above the roofing membrane or layer used to seal the roof from water penetration, the effective R-value of the insulation shall be as specified in Reference Joint Appendix JA4.
- (i) **Roofing Products Solar Reflectance and Thermal Emittance.**
1. In order to meet the requirements of Sections ~~140.1, 140.2, 140.3(a)1, 141.90(b)1B, 150.1(c)12, 150.2(b)1H or 150.2(b)2~~, a roofing product's thermal emittance and ~~an 3-year~~ aged solar reflectance shall be certified and labeled according to the requirements of Section 10-113.

EXCEPTION to Section 110.8(i)1: Roofing products that are not certified according to Section 10-113 shall assume the following default aged reflectance/emittance values:

 - A. For asphalt shingles, 0.08/0.75
 - B. For all other roofing products, 0.10/0.75
 2. If CRRC testing for ~~an 3-year~~ aged solar reflectance is not available for any roofing products, the ~~3-year~~ aged value shall be derived from the CRRC initial value using the equation $\rho_{aged} = [0.2 + \beta[\rho_{initial} - 0.2]] R_{aged} = [0.2 + 0.7[\rho_{initial} - 0.2]]$, where $\rho_{initial}$ = the initial solar reflectance and soiling resistance β is listed by product type in Table 110.8-A.

TABLE 110.8-A VALUES OF SOILING RESISTANCE β BY PRODUCT TYPE

Product Type	CRRC Product Category	β
Field-Applied Coating	Field-Applied Coating	0.65
Other	Not A Field-Applied Coating	0.70

3. Solar Reflectance Index (SRI), calculated as specified by ASTM E 1980-01, may be used as an alternative to thermal emittance and ~~an 3-year~~ aged solar reflectance when complying with the requirements of Sections ~~140.1~~, 140.2, 140.3(a)1, ~~140.9~~141.0(b)1B, 150.1(c)12, 150.2(b)1H, or 150.2(b)2. SRI calculations shall be based on moderate wind velocity of 2-6 meters per second. The SRI shall be calculated based on the ~~3-year~~ aged reflectance value of the roofing products.
4. Liquid applied roof coatings applied to low-sloped roofs in the field as the top surface of a roof covering shall:
 - A. Be applied across the entire roof surface to meet the dry mil thickness or coverage recommended by the coating manufacturer, taking into consideration the substrate on which the coating is applied, and
 - B. Meet the minimum performance requirements listed in **TABLE 110.8-CTABLE 118-BC** or the minimum performance requirements of ASTM C836, D3468, D6083, or D6694, whichever are appropriate to the coating material.

EXCEPTION 1 to Section 110.8(i)4B:

Aluminum-pigmented asphalt roof coatings shall meet the requirements of ASTM D2824 or ASTM D6848 and be installed as specified by ASTM D3805.

EXCEPTION 2 to Section 110.8(i)4B:

Cement-based roof coatings shall contain a minimum of 20 percent cement and shall meet the requirements of ASTM C1583, ASTM D822, and ASTM D5870.

TABLE 110.8-AB SLAB INSULATION REQUIREMENTS FOR HEATED SLAB-ON-GRADE

Insulation Location	Insulation Orientation	Installation Requirements	Climate Zone	Insulation R-Factor
Outside edge of heated slab, either inside or outside the foundation wall	Vertical	From the level of the top of the slab, down 16 inches or to the frost line, whichever is greater. Insulation may stop at the top of the footing where this is less than the required depth. For below grade slabs, vertical insulation shall be extended from the top of the foundation wall to the bottom of the foundation (or the top of the footing) or to the frost line, whichever is greater.	1 – 15	5
			16	10
Between heated slab and outside foundation wall	Vertical and Horizontal	Vertical insulation from top of slab at inside edge of outside wall down to the top of the horizontal insulation. Horizontal insulation from the outside edge of the vertical insulation extending 4 feet toward the center of the slab in a direction normal to the outside of the building in plan view.	1 – 15	5
			16	10 vertical and 7 horizontal

TABLE 110.8-CB MINIMUM PERFORMANCE REQUIREMENTS FOR LIQUID APPLIED ROOF COATINGS

Physical Property	ASTM Test Procedure	Requirement
Initial percent elongation (break)	D 2370	Minimum 200% 73° F (23° C)

SECTION 110.8 – MANDATORY REQUIREMENTS FOR INSULATION, AND ROOFING PRODUCTS AND RADIANT BARRIERS

Initial percent elongation (break) OR Initial Flexibility	D 2370 D522, Test B	Minimum 60% 0° F (-18° C) Minimum pass 1" mandrel 0° F (-18° C)
Initial tensile strength (maximum stress)	D 2370	Minimum 100 psi (1.38 Mpa) 73° F (23° C)
Initial tensile strength (maximum stress) OR Initial Flexibility	D 2370 D522, Test B	Minimum 200 psi (2.76 Mpa) 0° F (-18° C) Minimum pass 1" mandrel 0° F (-18° C)
Final percent elongation (break) after accelerated weathering 1000 h	D2370	Minimum 100% 73° F (23° C)
Final percent elongation (break) after accelerated weathering 1000 h OR Flexibility after accelerated weathering 1000h	D2370	Minimum 40% 0° F (-18° C) Minimum pass 1" mandrel 0° F (-18° C)
Permeance	D 1653	Maximum 50 perms
Accelerated weathering 1000 h	D 4798	No cracking or checking ¹
1. Any cracking or checking visible to the eye fails the test procedure.		

~~(j)——~~ **Radiant Barrier.** A radiant barrier shall have an emittance of 0.05 or less, tested in accordance with ASTM C1371 or ASTM E408, and shall be certified to the Department of Consumer Affairs as required by Title 24, Part 12, Chapter 12-13, Standards for Insulating Material.

110.9 All Mandatory Lighting

SECTION 110.9 – MANDATORY REQUIREMENTS FOR LIGHTING CONTROL DEVICES AND SYSTEMS, BALLASTS, AND LUMINAIRES

~~Any lighting control device, ballast, or luminaire subject to the requirements of Section 119 shall be installed only if the manufacturer has certified to the Commission that the device complies with all of the applicable requirements of Section 119.~~

~~Lighting control devices may be individual devices or systems consisting of two or more components. For control systems consisting of two or more components, such as an Energy Management Control System (EMCS), the manufacturer of the control system shall certify each of the components required for the system to comply with Section 119.~~

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

- ~~1. Shall be installed only if the lighting control device or system, ballast, or luminaire complies with all of the applicable requirements of Section 110.9.~~
- ~~2. Lighting controls may be individual devices (Self Contained Lighting Control) or systems (Lighting Control Systems) consisting of two or more components.~~
- ~~3. Self Contained Lighting Controls, as defined in Section 100.1, shall be certified by the Manufacturer as required by in accordance with the Title 20 Appliance Efficiency Regulations.~~
- ~~4. Lighting Control Systems, as defined in Section 100.1, shall be a fully functional lighting control system complying with the applicable requirements in Section 110.9(b), and shall meet the lighting control installation requirements in Section 130.4.~~
- ~~5. If indicator lights are integral to a lighting control system, they shall consume no more than one watt of power per indicator light. (a) — All Devices: Instructions for Installation and Calibration. The manufacturer shall provide step by step instructions for installation and start up calibration of the device.~~

~~(b) Indicator Lights. Indicator lights integral to lighting control devices shall consume no more than one watt of power per indicator light.~~

~~(c) Automatic Time Switch Control Devices. Automatic time switch control devices or system shall:~~

- ~~1. Be capable of programming different schedules for weekdays and weekends;~~
- ~~2. Have program backup capabilities that prevent the loss of the device's schedules for at least 7 days, and the device's time and date setting for at least 72 hours if power is interrupted.~~

~~(d) Occupant Sensors, Motion Sensors, and Vacancy Sensors. Occupant sensors, motion sensors, and vacancy sensors shall be capable of automatically turning off all the lights in an area no more than 30 minutes after the area has been vacated, and shall have a visible status signal that indicates that the device is operating properly or that it has failed or malfunctioned. The visible status signal may have an override switch that turns the signal off. In addition, ultrasonic and microwave devices shall have a built in mechanism that allows calibration of the sensitivity of the device to room movement in order to reduce the false sensing of occupants, and shall comply with either Item 1 or 2 below, as applicable:~~

- ~~1. If the device emits ultrasonic radiation as a signal for sensing occupants within an area, the device shall:~~

- ~~A. Have had a Radiation Safety Abbreviated Report submitted to the Center for Devices and Radiological Health, Federal Food and Drug Administration, under 21 Code of Federal Regulations, Section 1002.12 (1996), and a copy of the report shall have been submitted to the California Energy Commission; and~~
 - ~~B. Emit no audible sound; and~~
 - ~~C. Not emit ultrasound in excess of the decibel (dB) values shown in TABLE 119-A, measured no more than 5 feet from the source, on axis.~~
- ~~2. If the device emits microwave radiation as a signal for sensing occupants within the area, the device shall:~~
 - ~~A. Comply with all applicable provisions in 47 Code of Federal Regulations, Parts 2 and 15 (1996), and have an approved Federal Communications Commission Identifier that appears on all units of the device and that has been submitted to the California Energy Commission; and~~
 - ~~B. Not emit radiation in excess of 1 milliwatt per square centimeter measured at no more than 5 centimeters from the emission surface of the device; and~~
 - ~~C. Have permanently affixed to it installation instructions recommending that it be installed at least 12 inches from any area normally used by room occupants.~~
- ~~(e) Multi Level Occupant Sensor. Multi level occupant sensors shall have an automatic OFF function that turns off all the lights, and either an automatic or a manually controlled ON function capable of meeting all the multi level and uniformity requirements of Section 131(b) for the controlled lighting. The first stage shall be capable of activating between 30-70 percent of the lighting power in a room either through an automatic or manual action, and may be a switching or dimming system. After that event occurs the device shall be capable of all of the following actions when manually called to do so by the occupant:~~
 - ~~1. Activating the alternate set of lights.~~
 - ~~2. Activating 100 percent of the lighting power.~~
 - ~~3. Deactivating all lights.~~
- ~~(f) Automatic Daylighting Control Devices. Automatic daylighting control devices used to control lights in daylit zones shall:~~
 - ~~1. Be capable of reducing the power consumption of the general lighting in the controlled area by at least two thirds in response to the availability of daylight; and~~
 - ~~2. If the device is a dimmer controlling incandescent or fluorescent lamps, provide electrical outputs to lamps for reduced flicker operation through the dimming range, so that the light output has an amplitude modulation of less than 30 percent for frequencies less than 200 Hz, and without causing premature lamp failure; and~~
 - ~~3. If the devices reduce lighting in control steps, incorporate time delay circuits to prevent cycling of light level changes of less than 3 minutes and have a manual or automatic means of adjusting the deadband to provide separation of on and off points for each control step; and~~
 - ~~4. If the device is placed in calibration mode, automatically restore its time delay settings to normal operation programmed time delays after no more than 60 minutes; and~~
 - ~~5. Have a setpoint control that easily distinguishes settings to within 10 percent of full scale adjustment; and~~
 - ~~6. Have a light sensor that has a linear response with 5 percent accuracy over the range of illuminance measured by the light sensor; and~~
 - ~~7. Have a light sensor that is physically separated from where calibration adjustments are made, or is capable of being calibrated in a manner that the person initiating calibration is remote from the sensor during calibration to avoid influencing calibration accuracy.~~
- ~~(g) Interior Photosensors. Interior photosensor shall not have a mechanical slide cover or other device that permits easy unauthorized disabling of the control, and shall not be incorporated into a wall-mounted occupant sensor.~~

- ~~(h) Multi-level Astronomical Time-switch Controls. Multi-level astronomical time-switch controls used to control lighting in daylit zones shall:~~
- ~~1. Contain at least 2 separately programmable steps per zone that reduces illuminance in a relatively uniform manner as specified in Section 131(b); and~~
 - ~~2. Have a separate offset control for each step of 1 to 240 minutes; and~~
 - ~~3. Have sunrise and sunset prediction accuracy within +/- 15 minutes and timekeeping accuracy within 5 minutes per year; and~~
 - ~~4. Store astronomical time parameters (used to develop longitude, latitude, time zone) for at least 7 days if power is interrupted; and~~
 - ~~5. Display date/time, sunrise and sunset, and switching times for each step; and~~
 - ~~6. Have an automatic daylight savings time adjustment; and~~
 - ~~7. Have automatic time switch capabilities specified in Section 119(c).~~
- ~~(i) Outdoor Astronomical Time-switch Controls. Outdoor astronomical time-switch controls used to control outdoor lighting as specified in Section 132(c) shall:~~
- ~~1. Contain at least 2 separately programmable steps per function area; and~~
 - ~~2. Have the ability to independently offset the on and off times for each channel by 0 to 99 minutes before or after sunrise or sunset; and~~
 - ~~3. Have sunrise and sunset prediction accuracy within +/- 15 minutes and timekeeping accuracy within 5 minutes per year; and~~
 - ~~4. Store astronomical time parameters (used to develop longitude, latitude, time zone) for at least 7 days if power is interrupted; and~~
 - ~~5. Display date/time, sunrise and sunset; and~~
 - ~~6. Have an automatic daylight savings time adjustment; and~~
 - ~~7. Have automatic time switch capabilities specified in Section 119(c).~~
- ~~(j) Manual On Occupant Sensor (Residential) (Vacancy Sensor). A residential manual on occupant sensor (also known as a vacancy sensor) used to comply with Section 150(k) shall be a device or system which meets all of the following requirements:~~
- ~~1. Turns off the lighting automatically within 30 minutes or less after the room has been vacated in response to the absence of occupants in the room; and~~
 - ~~2. Has a visible status signal in accordance with Section 119(d); and~~
 - ~~3. Shall not turn on the lighting automatically, except the sensor shall have a grace period of 15 seconds to 30 seconds to turn on the lighting automatically after the sensor has timed out; and~~
 - ~~4. Shall not have an override switch that disables the occupant sensor; and~~
 - ~~5. Shall not have an override switch that converts the sensor from a manual on to an automatic on system.~~
- ~~(k) Dimmers. Dimmers used to control lighting shall:~~
- ~~1. Be capable of reducing power consumption by a minimum of 65 percent when the dimmer is at its lowest light level; and~~
 - ~~2. If the device is a dimmer controlling incandescent or fluorescent lamps, provide electrical outputs to lamps for reduced flicker operation through the dimming range, so that the light output has an amplitude modulation of less than 30 percent for frequencies less than 200 Hz, and without causing premature lamp failure; and~~
 - ~~3. Be listed by a rating lab recognized by the International Code Council (ICC) as being in compliance with Underwriters Laboratories Standards; and~~

4. ~~If the device is a wall box dimmer designed to be used in a three or more way circuit with non-dimmable switches, the level set by the dimmer shall not be overridden by any of the switches in the circuit. The dimmer and all of the switches in the circuit shall have the capability of turning lighting OFF if it is ON, and turning lighting ON to the level set by the dimmer if the lighting is OFF. Any wall box dimmer that is connected to a system with an emergency override function shall be controlled by the emergency override.~~
5. ~~If the device is a stepped dimmer, it shall include an off position to turn lights completely off.~~

(b) All Installed Lighting Control Systems listed in Section 110.9(b) shall comply with the requirements listed below; and all components of the system considered together as installed shall meet all applicable requirements for the application for which they are installed as required in Sections 130.0 through 130.5, Sections 140.6 through 140.8, Section 141.0, and Section 150.0(k).

1. Time-Switch Lighting Controls

- A. Automatic Time-Switch Controls shall meet all requirements for Automatic Time Switch Control devices in the Title 20 Appliance Efficiency Regulations.
- B. Astronomical Time-Switch Controls shall meet all requirements for Astronomical Time-Switch Control devices in the Title 20 Appliance Efficiency Regulations.
- C. Multi-Level Astronomical Time-Switch Controls, in addition to meeting all of the requirements for Astronomical Time-Switch Controls, shall include at least 2 separately programmable steps per zone.
- D. Outdoor Astronomical Time-Switch Controls, in addition to meeting all of the requirements for Astronomical Time-Switch Controls, shall have setback functions that allow the lighting on each controlled channel to be switched or dimmed to lower levels. The set back functions shall be capable of being programmed by the user for ~~any~~at least one specific time of ~~day and night~~.

2. Daylighting Controls

- A. Automatic Daylight Controls shall meet all requirements for Automatic Daylight Control devices in the Title 20 Appliance Efficiency Regulations.
- B. Photo Controls shall meet all requirements for Photo Control devices in the Title 20 Appliance Efficiency Regulations.

3. Dimmers shall meet all requirements for Dimmer Control devices in the Title 20 Appliance Efficiency Regulations.

4. Occupant Sensing Controls: Occupant, Motion, and Vacancy Sensor Controls shall meet the following requirements:

- A. Occupant Sensor shall meet all applicable requirements for occupant sensor control devices in the Title 20 Appliance Efficiency Regulations.
- B. Motion Sensor shall meet all applicable requirements for motion sensor controls devices in the Title 20 Appliance Efficiency Regulations.
- C. Vacancy Sensor shall meet all applicable requirements for vacancy sensor controls devices in the Title 20 Appliance Efficiency Regulations.

EXCEPTION to Section 110.9(b)4: Occupant Sensing Control systems may consist of a combination of single or multi-level Occupant, Motion, or Vacancy Sensor Controls, provided that components installed to comply with manual-on requirements shall not be capable of conversion by the user from manual-on to automatic-on functionality.

5. Part-Night Outdoor Lighting Controls, as defined in Section 100.1, shall meet all of the following requirements:

- A. Have sunrise and sunset prediction accuracy within +/- 15 minutes and timekeeping accuracy within five minutes per year.

B. Have the ability to setback or turn off lighting at night as required in Section 130.2(c), by means of a programmable timeclock or motion sensing device.

C. When controlled with a timeclock, shall be capable of being programmed to allow the setback or turning off of the lighting to occur from any time at night until any time in the morning, as determined by the user.

(4c) Track Lighting Integral Current Limiter. An integral current limiter for line-voltage track lighting shall be recognized for compliance with Title 24, Part 6 only if it meets all of the following requirements shall meet the following requirements or a method approved by the Executive Director:

1. Shall be certified to the Energy Commission as meeting all of the requirements in Section 110.9(c)
2. Shall comply with the Lighting Control Installation requirements in accordance with Section 130.4
3. Shall be manufactured so that the current limiter housing is used exclusively on the same manufacturer's track for which it is designed
4. Shall be designed so that the integral current limiter housing is permanently attached to the track so that the track-system will be irreparably damaged if the integral current limiter housing were to be removed after installation into the track. Methods of attachment may include but are not limited to one-way barbs, rivets, and one-way screws
5. Shall employ tamper resistant fasteners for the cover to the wiring compartment; and
6. Shall have the identical volt-ampere (VA) rating of the current limiter, as installed and rated for compliance with Title 24, Part 6, -clearly marked as follows:
 - A. clearly marked on the circuit breaker So that it is visible for the building officials' field inspection without opening coverplates, fixtures, or panels, and
 - B. Permanently marked on the circuit breaker, and
 - C. On a factory-printed label that is permanently affixed to a non-removable base-plate inside the wiring compartment

~~and also on a permanent factory installed label inside the wiring compartment Shall have that shall be identical to the rating; and~~

~~Employ tamper-resistant fasteners for the cover to the wiring compartment; and~~
7. Shall have a conspicuous permanent factory installed label permanently affixed to the inside of the wiring compartment warning against removing, tampering with, rewiring, or bypassing the device.
8. Each electrical panel from which track lighting integral current limiters are energized shall have a factory printed label permanently affixed and prominently located, stating the following: "NOTICE: Current limiting devices installed in track lighting integral current limiters connected to this panel shall only be replaced with the same or lower amperage. Adding track or replacement of existing current limiters with higher continuous ampere rating will void the track lighting integral current limiter certification, and will require re-submittal and re-certification to the California Energy Commission of California Title 24, Part 6 compliance documentation."

(d) Track Lighting Supplementary Overcurrent Protection Panel. A Track Lighting Supplementary Overcurrent Protection Panel shall be used only for line-voltage track lighting and shall be recognized for compliance with Title 24, Part 6 only if it meets all of the following requirements:

1. Shall comply with the Lighting Control Installation requirements in accordance with Section 130.4
2. Shall be listed as defined in Section 100.1
3. Shall be used only for line voltage track lighting. No other lighting or building power shall be used in a Supplementary Overcurrent Protection Panel used to determine input wattage for track lighting.
4. Be permanently installed in an electrical equipment room, or permanently installed adjacent to the lighting panel board providing supplementary overcurrent protection for the track lighting circuits served by the supplementary over current protection pane.

5. Shall have a permanently installed label that is prominently located stating the following: "NOTICE: This Panel for Track Lighting Energy Code Compliance Only. The overcurrent protection devices in this panel shall only be replaced with the same or lower amperage. No other overcurrent protective device shall be added to this panel. Adding to, or replacement of existing overcurrent protective device(s) with higher continuous ampere rating, will void the panel listing and require re-submittal and re-certification to the California Energy Commission of California Title 24, Part 6 compliance documentation."

(mc) **Residential High Efficacy Light Emitting Diode (LED) Lighting Systems.** To qualify as high efficacy for compliance with the residential lighting Standards in Section 150.0(k), a residential high efficacy LED luminaire, or LED light engine with integral heat sink shall meet the minimum efficacy requirements in TABLE 150-C and luminaire power shall be determined as specified by Section 130(d)5. shall be certified to the Energy Commission according to Reference Joint Appendix JA-8. LED lighting not certified to the Energy Commission shall be classified as low efficacy for compliance with Section 150.0(k). Nonresidential LED lighting shall not be required to be certified to the Energy Commission.

(nf) **Ballasts for Residential Recessed Luminaires.** To qualify as high efficacy for compliance with Section 150.0(k), any compact fluorescent lamp ballast in a residential recessed luminaire shall meet all of the following conditions:

1. Be rated by the ballast manufacturer to have a minimum rated life of 30,000 hours when operated at or below a specified maximum case temperature. This maximum ballast case temperature specified by the ballast manufacturer shall not be exceeded when tested in accordance to UL 1598 Section 19.15; and
2. Have a ballast factor of not less than 0.90 for non-dimming ballasts and a ballast factor of not less than 0.85 for dimming ballasts.

~~(o) Dimmable Fluorescent Ballasts for Power Adjustment Factor. To qualify for the Power Adjustment Factor in Section 146(a)2 and TABLE 146-C, ballasts for T5 and T8 linear fluorescent lamps shall be electronic, dimmable, and shall meet the minimum Relative System Efficiency (RSE) in TABLE 146-D.~~

TABLE 119-A ULTRASOUND MAXIMUM DECIBEL VALUES

MIDFREQUENCY OF SOUND PRESSURE THIRD-OCTAVE BAND (in kHz)	MAXIMUM dB LEVEL WITHIN THIRD-OCTAVE BAND (in dB-reference 20 micropascals)
Less than 20	80
20 or more to less than 25	105
25 or more to less than 31.5	110
31.5 or more	115

SECTION 110.10 – MANDATORY REQUIREMENTS FOR SOLAR READY BUILDINGS

(a) Buildings listed below shall provide for the future installation of a solar electric or solar thermal system.

- 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 authority having jurisdiction, 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 with eight or more dwelling units or with a water heating system serving multiple dwelling units 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 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 area as described below. The required area may be divided into noncontiguous sections, with a minimum section area of 80 square feet. No dimension of the solar zone shall be less than five feet.
 - A. Single Family Residences.** The solar zone shall have a minimum area of 250 square feet.

EXCEPTION 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 shall have a solar zone with a minimum area of 150 square feet.
 - B. Low-rise Multi-Family Buildings.** The solar zone shall have a minimum area equal to 15 percent of the total roof area excluding any skylight area.

EXCEPTION 1 to Section 110.10(b)1B: An alternate reserved space for the future installation of a solar electric or solar thermal system with an area equal to 30 percent of the total roof area may be located elsewhere on the building site in lieu of the solar zone.

EXCEPTION 2 to Section 110.10(b)1B: Buildings that install a solar water-heating system complying with the requirements of Section 150.1(c)8Ciii.
 - C. Hotel/Motel Occupancies and High-rise Multi-Family Buildings.**
 - i. Buildings with ten stories or fewer.** The solar zone shall have a minimum area equal to 15 percent of the total roof area excluding any skylight area.
 - ii. Buildings with greater than ten stories.** The solar zone shall have a minimum area equal to 1.5 percent of the total roof area excluding any skylight area times the number of stories and a maximum area equal to 30 percent of the total roof excluding any skylight area.

EXCEPTION 1 to Section 110.10(b)1C: An alternate reserved space for the future installation of a solar electric or solar thermal system with an area equal to two times the otherwise required area of the solar zone may be located elsewhere on the building site in lieu of the solar zone.

EXCEPTION 2 to Section 110.10(b)1C: Buildings that install a solar water-heating system complying with the requirements of Section 150.1(c)8Ciii.
 - D. All Other Nonresidential Buildings.** The solar zone shall have a minimum area equal to 40 percent of the total roof area excluding any skylight area.

EXCEPTION to Section 110.10(b)1D: An alternate reserved space for the future installation of a solar electric or solar thermal system with an area equal to 60 percent of the total roof area may be located elsewhere on the building site in lieu of the solar zone.

EXCEPTION to Section 110.10(b)1: The area of any permanent solar electric or solar thermal system installed on the building site, including non-roof installations, at the time of construction shall be counted as part of the solar zone minimum area requirement. Solar thermal systems that provide water heating exclusively for swimming pools or spas shall not be counted as part of the solar zone minimum area requirement.

NOTE: The solar zone shall comply with access, pathway, smoke ventilation, and spacing requirements as specified in Title 24, Part 9 (California Fire Code) or in any similar requirements adopted by a local jurisdiction.

2. Orientation. All sections of the solar zone shall be either oriented between 110 degrees and 270 degrees of true north or located on a flat roof.

3. Shading.

A. No roof obstructions, including but not limited to, vents, chimneys, architectural features, and roof mounted equipment, shall be located in the solar zone.

B. Any obstruction 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. Obstructions subject to this requirement include:

iii. Any vent, chimney, architectural feature, roof mounted equipment or other obstruction that is on the roof or any other part of the building.

EXCEPTION to Section 110.10(b)3: Any roof obstruction that is oriented north of all points on the solar zone.

4. Structural Integrity. The as-designed roof dead load and live load for the solar zone shall be clearly indicated on the construction documents.

EXCEPTION to Section 110.10(b)4: If an alternate reserved space located elsewhere on the building site is provided in lieu of the solar zone, the requirements of Section 110.10(b)4 shall not apply.

(c) Interconnection Pathways.

1. The construction documents shall indicate a pathway for routing of conduit from the solar zone or alternate reserved space to the main electrical service panel of the building.

2. The construction documents shall indicate a pathway for routing of plumbing from the solar zone or alternate reserved space to the building's water-heating system.

(d) Documentation. A copy of the construction documents or a comparable document indicating the information from Section 110.10(b) through Section 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".

EXCEPTION 1 to Section 110.10: If documented that there is no viable solar zone, or alternate reserved space where allowed, due to shading which reduces the annual solar access to 70% or less, the requirements of Section 110.10 shall not apply. Solar access is the ratio of solar insolation on a given roof section or alternate reserved space including shade to the solar insolation available on that roof section or alternate reserved space without shade. It must be documented that all viable roof sections or alternate reserved spaces have insufficient annual solar access. Shading from on roof obstructions shall not be included in the determination of annual solar access.

EXCEPTION 2 to Section 110.10: If the roof of the building is designed and approved to be used for vehicular traffic or parking, the requirements of Section 110.10 shall not apply.

120.0 to 120.6-9 NR Mandatory Equipment

SUBCHAPTER 3

NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, ~~AND HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES~~—MANDATORY REQUIREMENTS ~~FOR SPACE-CONDITIONING AND SERVICE WATER-HEATING SYSTEMS AND EQUIPMENT~~

~~SECTION 120.0—SPACE-CONDITIONING AND SERVICE WATER-HEATING SYSTEMS AND EQUIPMENT—GENERAL~~

Sections ~~120.1~~ through 120.9 establish requirements for the design and installation of building envelopes, ventilation, space-conditioning and service water-heating systems and equipment in nonresidential, high-rise residential, and hotel/motel buildings as well as covered processes that are subject to Title 24, Part 6. All such buildings and covered processes shall comply with the applicable provisions of Sections ~~120.1~~ through 120.9.

SECTION 120.1 – REQUIREMENTS FOR VENTILATION

All nonresidential, high-rise residential, and hotel/motel occupancies shall comply with the requirements of Section 120.1(a) through 120.1(e).

(a) General Requirements.

1. All enclosed spaces in a building ~~that are normally used by humans~~ shall be ventilated in accordance with the requirements of this section and the CBC.

EXCEPTION to Section 120.1(a)1: Refrigerated warehouses and other spaces or buildings that are not normally used for human occupancy and work.

2. The outdoor air-ventilation rate and air-distribution assumptions made in the design of the ventilating system shall be clearly identified on the plans required by Section 10-103 of Title 24, Part 1.

(b) Design Requirements for Minimum Quantities of Outdoor Air. Every space in a building shall be designed to have outdoor air ventilation according to Item 1 or 2 below:

1. Natural ventilation.

- A. Naturally ventilated spaces shall be permanently open to and within 20 feet of operable wall or roof openings to the outdoors, the openable area of which is not less than 5 percent of the conditioned floor area of the naturally ventilated space. Where openings are covered with louvers or otherwise obstructed, openable area shall be based on the free unobstructed area through the opening.

EXCEPTION to Section 120.1(b)1A: Naturally ventilated spaces in high-rise residential dwelling units and hotel/motel guest rooms shall be open to and within 25 feet of operable wall or roof openings to the outdoors.

- B. The means to open required operable openings shall be readily accessible to building occupants whenever the space is occupied.

2. **Mechanical ventilation.** Each space that is not naturally ventilated under Item 1 above shall be ventilated with a mechanical system capable of providing an outdoor air rate no less than the larger of:
- The conditioned floor area of the space times the applicable ventilation rate from [TABLE 120.1-A](#); or
 - 15 cfm per person times the expected number of occupants.

For meeting the requirement in Section [120.1\(b\)2B](#) for spaces without fixed seating, the expected number of occupants shall be either the expected number specified by the building designer or one half of the maximum occupant load assumed for egress purposes in the CBC, whichever is greater. For spaces with fixed seating, the expected number of occupants shall be determined in accordance with the CBC.

EXCEPTION to Section [120.1\(b\)2](#): Transfer air. The rate of outdoor air required by Section [120.1\(b\)2](#) may be provided with air transferred from other ventilated spaces if:

- None of the spaces from which air is transferred have any unusual sources of indoor air contaminants; and
- The outdoor air that is supplied to all spaces combined, is sufficient to meet the requirements of Section [120.1\(b\)2](#) for each space individually.

(c) **Operation and Control Requirements for Minimum Quantities of Outdoor Air.**

- Times of occupancy.** The minimum rate of outdoor air required by Section [120.1\(b\)2](#) shall be supplied to each space at all times when the space is usually occupied.

EXCEPTION 1 to Section [120.1\(c\)1](#): Demand control ventilation. In intermittently occupied spaces that do not have processes or operations that generate dusts, fumes, mists, vapors or gasses and are not provided with local exhaust ventilation (such as indoor operation of internal combustion engines or areas designated for unvented food service preparation), the rate of outdoor air may be reduced if the ventilation system serving the space is controlled by a demand control ventilation device complying with Section [120.1\(c\)4](#) or by an occupant sensor ventilation control device complying with Section [120.1\(c\)5](#).

EXCEPTION 2 to Section [120.1\(c\)1](#): Temporary reduction. The rate of outdoor air provided to a space may be reduced below the level required by Section [120.1\(b\)2](#) for up to 5 minutes each hour if the average rate for each hour is equal to or greater than the required ventilation rate.

~~**NOTE:** VAV must comply with Section [121\(c\)1](#) at minimum supply airflow.~~

- Pre-occupancy.** The lesser of the minimum rate of outdoor air required by Section [120.1\(b\)2](#) or 3 complete air changes shall be supplied to the entire building during the 1-hour period immediately before the building is normally occupied.
- Required Demand Control Ventilation.** HVAC systems with the following characteristics shall have demand ventilation controls complying with [120.1\(c\)4](#):
 - They have an air economizer; and
 - They serve a space with a design occupant density, or a maximum occupant load factor for egress purposes in the CBC, greater than or equal to 25 people per 1000 ft² (40 square foot or less per person); and
 - They are either:
 - Single zone systems with any controls; or
 - Multiple zone systems with Direct Digital Controls (DDC) to the zone level.

EXCEPTION 1 to Section [120.1\(c\)3](#): Classrooms, call centers, office spaces served by multiple zone systems that are continuously occupied during normal business hours with occupant density greater than 25 people per 1000 ft² per Section [120.1\(b\)2B](#), healthcare facilities and medical buildings, and public areas of social services buildings are not required to have demand control ventilation.

EXCEPTION 2 to Section [120.1\(c\)3](#): Where space exhaust is greater than the design ventilation rate specified in Section [120.1\(b\)2B](#) minus 0.2 cfm per ft² of conditioned area.

EXCEPTION 3 to Section [120.1\(c\)3](#): Spaces that have processes or operations that generate dusts, fumes, mists, vapors, or gasses and are not provided with local exhaust ventilation, such as indoor operation of internal

combustion engines or areas designated for unvented food service preparation, or beauty salons shall not install demand control ventilation.

EXCEPTION 4 to Section ~~121~~120.1(c)3: Spaces with an area of less than 150 square feet, or a design occupancy of less than 10 people per Section ~~121~~120.1(b)2B.

EXCEPTION 5 to Section 120.1(c)3: Spaces with an area of less than 1,500 square feet complying with 120.1(c)5.

4. Demand Control Ventilation Devices.

- A. For each system with demand control ventilation, CO₂ sensors shall be installed in each room that meets the criteria of Section ~~121~~120.1(c)3B with no less than one sensor per 10,000 ft² of floor space. When a zone or a space is served by more than one sensor, signal from any sensor indicating that CO₂ is near or at the setpoint within a space, shall trigger an increase in ventilation to the space;
- B. CO₂ sensors shall be located in the room between 3 ft and 6 ft above the floor or at the anticipated height of the occupants heads;
- C. Demand ventilation controls shall maintain CO₂ concentrations less than or equal to 600 ppm plus the outdoor air CO₂ concentration in all rooms with CO₂ sensors;

EXCEPTION to Section ~~121~~120.1(c)4C: The outdoor air ventilation rate is not required to be larger than the design outdoor air ventilation rate required by Section ~~121~~120.1(b)2 regardless of CO₂ concentration.

- D. Outdoor air CO₂ concentration shall be determined by one of the following:
 - i. CO₂ concentration shall be assumed to be 400 ppm without any direct measurement; or
 - ii. CO₂ concentration shall be dynamically measured using a CO₂ sensor located within 4 ft of the outdoor air intake.
- E. When the system is operating during hours of expected occupancy, the controls shall maintain system outdoor air ventilation rates no less than the rate listed in ~~TABLE 120.1-A~~TABLE 120.1 A ~~TABLE 121-A~~ times the conditioned floor area for spaces with CO₂ sensors, plus the rate required by Section ~~121~~120.1(b)2 for other spaces served by the system, or the exhaust air rate whichever is greater;
- F. CO₂ sensors shall be certified by the manufacturer to be accurate within plus or minus 75 ppm at a 600 and 1000 ppm concentration when measured at sea level and 25°C, factory calibrated ~~or calibrated at start up~~, and certified by the manufacturer to require calibration no more frequently than once every 5 years. Upon detection of sensor failure, the system shall provide a signal which resets to supply the minimum quantity of outside air to levels required by Section ~~121~~120.1(b)2 to the zone serviced by the sensor at all times that the zone is occupied.
- G. The CO₂ sensor(s) reading for each zone shall be displayed continuously, and shall be recorded on systems with DDC to the zone level.

5. Occupant Sensor Ventilation Control Devices. When occupancy sensor ventilation devices are required by Section 120.2(e)3 or EXCEPTION 5 to Section 120.1(c)3, occupant sensors shall be used to reduce the rate of outdoor air flow when occupants are not present in accordance with the following:

- A. Occupant sensors shall meet requirements in Section 110.9(b)4 and shall have suitable coverage and placement to detect occupants in the entire space ventilated. Occupant sensors controlling lighting may be used for ventilation as long as the ventilation signal is independent of daylighting, manual lighting overrides or manual control of lighting. When a single zone damper or a single zone system serves multiple rooms, there shall be an occupancy sensor in each room and the zone is not considered vacant until all rooms in the zone are vacant.
- B. One hour prior to normal scheduled occupancy, the occupancy sensor ventilation control shall allow pre-occupancy purge as described in Section 120.1(c)2.
- C. Within 30 minutes following vacancy in all rooms served by a zone damper on a multiple zone system, and the occupant does not require cooling or heating, then no outside air is required and supply air shall be zero.

D. Within 30 minutes following vacancy in all rooms served by a single zone system, the single zone system shall cycle off the supply fan when the occupant does not require cooling or heating.

(d) **Ducting for Zonal Heating and Cooling Units.** Where a return plenum is used to distribute outdoor air to a zonal heating or cooling unit which then supplies the air to a space in order to meet the requirements of Section ~~120.1~~120.1(b)2, the outdoor air shall be ducted to discharge either:

1. Within 5 feet of the unit; or
2. Within 15 feet of the unit, substantially toward the unit, and at a velocity not less than 500 feet per minute.

(e) **Design and Control Requirements for Quantities of Outdoor Air.**

1. All mechanical ventilation and space-conditioning systems shall be designed with and have installed ductwork, dampers, and controls to allow outside air rates to be operated at the larger of (1) the minimum levels specified in Section 120.1(b)1 or (2) the rate required for make-up of exhaust systems that are required for an exempt or covered process, for control of odors, or for the removal of contaminants within the space.
2. All variable air volume mechanical ventilation and space-conditioning systems shall include dynamic controls that maintain measured outside air ventilation rates within 10% of the required outside air ventilation rate at both full and reduced supply airflow conditions. Fixed minimum damper position is not considered to be dynamic and is not an allowed control strategy.
3. Measured outdoor air rates of constant volume mechanical ventilation and space-conditioning systems shall be within 10% of the required outside air rate.

TABLE ~~120.1-A~~ 120.1-A MINIMUM VENTILATION RATES

TYPE OF USE	CFM PER SQUARE FOOT OF CONDITIONED FLOOR AREA
Auto Repair Workshops	1.50
Barber Shops	0.40
Bars, cocktail lounges, and casinos	0.20
Beauty shops	0.40
Coin-operated dry cleaning	0.30
Commercial dry cleaning	0.45
High-rise residential	Ventilation Rates Specified by the CBC
Hotel guest rooms (less than 500 ft ²)	30 cfm/guest room
Hotel guest rooms (500 ft ² or greater)	0.15
Retail stores	0.20
All others	0.15

SECTION ~~122120.2~~ 122120.2 – REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS

Space-conditioning systems shall be installed with controls that comply with the applicable requirements of Subsections (a) through (h).

(a) **Thermostatic Controls for Each Zone.** The supply of heating and cooling energy to each space-conditioning zone or dwelling unit shall be controlled by an individual thermostatic control that responds to temperature within the zone and that meets the applicable requirements of Section ~~122120.2~~122120.2(b).

EXCEPTION to Section ~~122120.2~~122120.2(a): An independent perimeter heating or cooling system may serve more than one zone without individual thermostatic controls if:

- A. All zones are also served by an interior cooling system;
- B. The perimeter system is designed solely to offset envelope heat losses or gains;
- C. The perimeter system has at least one thermostatic control for each building orientation of 50 feet or more; and
- D. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.

(b) **Criteria for Zonal Thermostatic Controls.** The individual thermostatic controls required by Section ~~122~~120.2(a) shall meet the following requirements as applicable:

- 1. Where used to control comfort heating, the thermostatic controls shall be capable of being set, locally or remotely, down to 55°F or lower.
- 2. Where used to control comfort cooling, the thermostatic controls shall be capable of being set, locally or remotely, up to 85°F or higher.
- 3. Where used to control both comfort heating and comfort cooling, the thermostatic controls shall meet Items 1 and 2 and shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

EXCEPTION to Section ~~122~~120.2(b)3: Systems with thermostats that require manual changeover between heating and cooling modes.

- 4. Thermostatic controls for all unitary single zone, air conditioners, heat pumps, and furnaces, shall comply with the setback thermostat requirements of Section ~~110~~120.2(c) or, if equipped with DDC to the Zone level, with the Automatic Demand Shed Controls of Section ~~122~~120.2(h).

EXCEPTION to Section ~~122~~120.2(b)4: Systems serving ~~zones-exempt process loads~~ that must have constant temperatures to prevent degradation of materials, a process, plants or animals.

(c) **Hotel/Motel Guest Room and High-rise Residential Dwelling Unit Thermostats.**

~~1.~~ 1. Hotel/motel guest room thermostats shall ~~have:~~

- ~~1.~~ 1. ~~A. Have N~~numeric temperature setpoints in °F ~~and °C~~; and
- ~~2.~~ 2. ~~B. Have S~~setpoint stops, ~~which are~~ accessible only to authorized personnel, ~~to restrict over heating and over cooling~~ such that guest room occupants cannot adjust the setpoint more than ±5°F (±3°C); ~~and~~
- ~~C. Meet the applicable requirements of Sections 150.0(i) and 150.0(f).~~

~~2.~~ 2. High-rise residential dwelling unit thermostats shall meet the control requirements of Section ~~150~~120.0(i).

(d) **Heat Pump Controls.** All heat pumps with supplementary electric resistance heaters shall be installed with controls that comply with Section ~~110~~120.2(b).

(e) **Shut-off and Reset Controls for Space-conditioning Systems.** Each space-conditioning system shall be installed with controls that comply with ~~Items 1 and 2 below the following:~~

- 1. The control shall be capable of automatically shutting off the system during periods of nonuse and shall have:
 - A. An automatic time switch control device complying with Section ~~110~~120.9, with an accessible manual override that allows operation of the system for up to 4 hours; or
 - B. An occupancy sensor; or
 - C. A 4-hour timer that can be manually operated.

EXCEPTION to Section ~~122~~120.2(e)1: Mechanical systems serving retail stores and associated malls, restaurants, grocery stores, churches, and theaters equipped with 7-day programmable timers.

2. The control shall automatically restart and temporarily operate the system as required to maintain:

- A. A setback heating thermostat setpoint if the system provides mechanical heating; and

EXCEPTION to Section 122120.2(e)2A: Thermostat setback controls are not required in nonresidential buildings in areas where the Winter Median of Extremes outdoor air temperature determined in accordance with Section 140.4(b)4 is greater than 32°F.

B. A setup cooling thermostat setpoint if the system provides mechanical cooling.

EXCEPTION to Section 122120.2(e)2B: Thermostat setup controls are not required in nonresidential buildings in areas where the Summer Design Dry Bulb 0.5 percent temperature determined in accordance with Section 140.4(b)4 is less than 100°F.

Classrooms greater than 750 ft² and conference, convention, auditorium and meeting center rooms greater than 750 ft² shall be equipped with occupant sensor(s) to accomplish the following during unoccupied periods:

A. Automatically setup the operating cooling temperature set point by 2°F or more and setback the operating heating temperature set point by 2°F or more; and

B. Automatically reset the minimum required ventilation rate with an occupant sensor ventilation control device according to Section 120.1(c)5.

EXCEPTION 1 to Section 122120.2(e): Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.

EXCEPTION 2 to Section 122120.2(e): Where it can be demonstrated to the satisfaction of the enforcing agency that shutdown, setback, and setup will not result in a decrease in overall building source energy use.

EXCEPTION 3 to Section 122120.2(e): Systems with full load demands of 2 kW or less, if they have a readily accessible manual shut-off switch.

EXCEPTION 4 to Section 122120.2(e): Systems serving hotel/motel guest rooms, if they have a readily accessible manual shut-off switch.

- (f) **Dampers for Air Supply and Exhaust Equipment.** Outdoor air supply and exhaust equipment shall be installed with dampers that automatically close upon fan shutdown.

EXCEPTION 1 to Section 122120.2(f): Where it can be demonstrated to the satisfaction of the enforcing agency that the equipment serves an area that must operate continuously.

EXCEPTION 2 to Section 122120.2(f): Gravity and other nonelectrical equipment that has readily accessible manual damper controls.

EXCEPTION 3 to Section 122120.2(f): At combustion air intakes and shaft vents.

EXCEPTION 4 to Section 122120.2(f): Where prohibited by other provisions of law.

- (g) **Isolation Area Devices.** 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.

1. Each zone, or any combination of zones not exceeding 25,000 square feet, shall be a separate isolation area.
2. Each isolation area shall be provided with isolation devices, such as valves or dampers that allow the supply of heating or cooling to be reduced or shut-off independently of other isolation areas.
3. Each isolation area shall be controlled by a device meeting the requirements of Section 122120.2(e)1.

EXCEPTION to Section 122120.2(g): A zone need not be isolated if it can be demonstrated to the satisfaction of the enforcement agency that the zone must be heated or cooled continuously.

- (h) **Automatic Demand Shed Controls.** HVAC systems with DDC to the Zone level shall be programmed to allow centralized demand shed for non-critical zones as follows:

1. The controls shall have a capability to remotely setup the operating cooling temperature set points by 4 degrees or more in all non-critical zones on signal from a centralized contact or software point within an Energy Management Control System (EMCS).
2. The controls shall have a capability to remotely setdown the operating heating temperature set points by 4 degrees or more in all non-critical zones on signal from a centralized contact or software point within an EMCS.

3. The controls shall have capabilities to remotely reset the temperatures in all non-critical zones to original operating levels on signal from a centralized contact or software point within an EMCS.
4. The controls shall be programmed to provide an adjustable rate of change for the temperature setup and reset.
5. The controls shall have the following features:
 - A. Disabled. Disabled by authorized facility operators; and
 - B. Manual control. Manual control by authorized facility operators to allow adjustment of heating and cooling set points globally from a single point in the EMCS; and
 - C. Automatic Demand Shed Control. Upon receipt of a demand response signal, the space-conditioning systems shall conduct a centralized demand shed, as specified in 120.2(h)1 and 120.2(h)2, for non-critical zones during the demand response period.
- (i) Economizer Fault Detection and Diagnostics (FDD). All air-cooled unitary direct-expansion units, equipped with an economizer and mechanical cooling capacity at AHRI conditions of greater than or equal to 54,000 Btu/hr, shall include a Fault Detection and Diagnostics (FDD) system in accordance with NA9 – Fault Detection and Diagnostics. Air-cooled unitary direct expansion units include packaged, split-systems, heat pumps, and variable refrigerant flow (VRF), where the VRF capacity is defined by that of the condensing unit.

SECTION ~~123~~120.3 – REQUIREMENTS FOR PIPE INSULATION

The piping for all space-conditioning and service water-heating systems with fluid temperatures listed in TABLE 120.3-~~ATABLE 120.3-ATABLE 123-A~~ shall have the amount of insulation specified in Subsection (a) or (b). Insulation conductivity shall be determined in accordance with ASTM C335 at the mean temperature listed in TABLE 120.3-~~ATABLE 120.3-ATABLE 123-A~~, and shall be rounded to the nearest 1/100 Btu-inch per hour per square foot per °F.

Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind, including but not limited to, the following:

Insulation exposed to weather shall be suitable for outdoor service e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include a vapor retardant located outside the insulation (unless the insulation is inherently vapor retardant), all penetrations and joints of which shall be sealed.

EXCEPTION 1 to Section ~~123~~120.3: Factory-installed piping within space-conditioning equipment certified under Section 111 or 112.

EXCEPTION 2 to Section ~~123~~120.3: Piping that conveys fluids with a design operating temperature range between 60°F and 105°F.

EXCEPTION 3 to Section ~~123~~120.3: ~~Piping that serves process loads;~~ Gas piping, cold domestic water piping, condensate drains, roof drains, vents, or waste piping.

EXCEPTION 4 to Section ~~123~~120.3: Where the heat gain or heat loss to or from piping without insulation will not increase building source energy use.

EXCEPTION 5 to Section ~~123~~120.3: Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing.

- (a) For insulation with a conductivity in the range shown in TABLE 120.3-~~ATABLE 120.3-ATABLE 123-A~~ for the applicable fluid temperature range, the insulation shall have the applicable thickness shown in TABLE 120.3-~~ATABLE 120.3-ATABLE 123-A~~.

- (b) For insulation with a conductivity outside the range shown in ~~TABLE 120.3-A~~ ~~TABLE 120.3-A~~ ~~TABLE 123-A~~ for the applicable fluid temperature range, the insulation shall have a minimum thickness as calculated with ~~EQUATION 120.3-A~~ ~~EQUATION 120.3-A~~ ~~EQUATION 123-A~~:

~~EQUATION 123-120.3-A~~ INSULATION THICKNESS EQUATION

$$T = PR \left[\left(1 + \frac{t}{PR} \right)^{\frac{K}{k}} - 1 \right]$$

WHERE:

- T = Minimum insulation thickness for material with conductivity K, inches.
- PR = Pipe actual outside radius, inches.
- t = Insulation thickness from ~~TABLE 120.3-A~~ ~~TABLE 120.3-A~~ ~~TABLE 123-A~~, inches.
- K = Conductivity of alternate material at the mean rating temperature indicated in ~~TABLE 120.3-A~~ ~~TABLE 120.3-A~~ ~~TABLE 123-A~~ for the applicable fluid temperature range, in Btu-inch per hour per square foot per °F.
- k = The lower value of the conductivity range listed in ~~TABLE 120.3-A~~ ~~TABLE 120.3-A~~ ~~TABLE 123-A~~ for the applicable fluid temperature range, Btu-inch per hour per square foot per °F.

~~TABLE 123-120.3-A~~ PIPE INSULATION THICKNESS

FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)				
			Runouts up to 2 and less	1.25-21 to <1.5-1/2	2.50-41.5-1/2 to <4	5-64 to <8	8 and larger
INSULATION THICKNESS REQUIRED (in inches)							
Space heating and Hot Water systems (steam, steam condensate and hot water heating and Domestic Water Systems)							
Above 350	0.32-0.34	250	1.5 2.54.5	2.55.0	3.05.0	5.03.5	5.03.5
251-350	0.29-0.31	200	1.5 3.02.0	2.54.0	2.54.5	3.54.5	3.54.5
201-250	0.27-0.30	150	1.0 1.52.5	1.52.5	2.02.5	2.03.0	3.53.0
141-200	0.25-0.29	125	0.5 1.5	1.5	1.52.0	1.52.0	2.01.5
105-140	0.224-0.28	100	0.5 1.0	1.0	1.01.5	1.5	1.5
Service water heating systems (recirculating sections, all piping in electric trace tape systems, and the first 8 feet of piping from the storage tank for nonrecirculating systems)							
Above 105	0.24-0.28	100	0.5	1.0	1.0	1.5	1.5
Space cooling systems (chilled water, refrigerant and brine)							
40-60	0.213-0.27	75	0.5 0.5	0.5	1.0	1.0	1.0
Below 40	0.230-0.276	75.50	1.0 1.0	1.5	1.5	1.5	1.5

SECTION ~~124~~120.4 – REQUIREMENTS FOR AIR DISTRIBUTION SYSTEM DUCTS AND PLENUMS

- (a) **CMC Compliance.** All air distribution system ducts and plenums, including, but not limited to, building cavities, mechanical closets, air-handler boxes and support platforms used as ducts or plenums, shall be installed, sealed and insulated to meet the requirements of the ~~2007-2010~~ CMC Sections 601, 602, 603, 604, 605, and ~~ANSI/SMACNA-006-2006 HVAC Duct Construction Standards Metal and Flexible 3rd Edition~~ Standard 6-5, incorporated herein by reference. Connections of metal ducts and the inner core of flexible ducts shall be mechanically fastened. Openings shall be sealed with mastic, tape, aerosol sealant, or other duct-closure system that meets the applicable requirements of UL 181, UL 181A, or UL 181B. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used.

Portions of supply-air and return-air ducts conveying heated or cooled air located in one or more of the following spaces shall be insulated to a minimum installed level of R-8:

1. Outdoors; or
2. In a space between the roof and an insulated ceiling; or
3. In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces; or
4. In an unconditioned crawlspace; or
5. In other unconditioned spaces.

Portions of supply-air ducts that are not in one of these spaces, including ducts buried in concrete slab, shall be insulated to a minimum installed level of R-4.2 (or any higher level required by CMC Section 605) or be enclosed in directly conditioned space.

(b) **Duct and Plenum Materials.**

1. **Factory-fabricated duct systems.**
 - A. All factory-fabricated duct systems shall comply with UL 181 for ducts and closure systems, including collars, connections, and splices, and be labeled as complying with UL 181. UL 181 testing may be performed by UL laboratories or a laboratory approved by the Executive Director.
 - B. All pressure-sensitive tapes, heat-activated tapes, and mastics used in the manufacture of rigid fiberglass ducts shall comply with UL 181 and UL 181A.
 - C. All pressure-sensitive tapes and mastics used with flexible ducts shall comply with UL 181 and UL 181B.
 - D. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.
2. **Field-fabricated duct systems.**
 - A. Factory-made rigid fiberglass and flexible ducts for field-fabricated duct systems shall comply with UL 181. All pressure-sensitive tapes, mastics, aerosol sealants, or other closure systems used for installing field-fabricated duct systems shall meet the applicable requirements of UL 181, UL 181A, and UL 181B.
 - B. Mastic sealants and mesh.
 - i. Sealants shall comply with the applicable requirements of UL 181, UL 181A, and UL 181B, and be nontoxic and water resistant.
 - ii. Sealants for interior applications shall pass ASTM tests C731 (extrudability after aging) and D2202 (slump test on vertical surfaces), incorporated herein by reference.
 - iii. Sealants for exterior applications shall pass ASTM tests C731, C732 (artificial weathering test), and D2202, incorporated herein by reference.

- iv. Sealants and meshes shall be rated for exterior use.
- C. Pressure-sensitive tape. Pressure-sensitive tapes shall comply with the applicable requirements of UL 181, UL 181A, and UL 181B.
- D. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.
- E. Drawbands used with flexible duct.
 - i. Drawbands shall be either stainless-steel worm-drive hose clamps or UV-resistant nylon duct ties.
 - ii. Drawbands shall have a minimum tensile strength rating of 150 pounds.
 - iii. Drawbands shall be tightened as recommended by the manufacturer with an adjustable tensioning tool.
- F. Aerosol-sealant closures.
 - i. Aerosol sealants shall meet the requirements of UL 723 and be applied according to manufacturer specifications.
 - ii. Tapes or mastics used in combination with aerosol sealing shall meet the requirements of this section.
- (c) All duct insulation product R-values shall be based on insulation only (excluding air films, vapor ~~barriers~~~~retarder~~, or other duct components) and tested C-values at 75°F mean temperature at the installed thickness, in accordance with ASTM C518 or ASTM C177, incorporated herein by reference, and certified pursuant to Section 110.8.
- (d) The installed thickness of duct insulation used to determine its R-value shall be determined as follows:
 - 1. For duct board, duct liner, and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
 - 2. For duct wrap, installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
 - 3. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.
- (e) Insulated flexible duct products installed to meet this requirement must include labels, in maximum intervals of 3 feet, showing the thermal performance R-value for the duct insulation itself (excluding air films, vapor ~~retarder~~~~barriers~~, or other duct components), based on the tests in Section ~~124~~~~120.4~~(c) and the installed thickness determined by Section ~~124~~~~120.4~~(d)3.
- (f) **Protection of Insulation.** Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind but not limited to the following: Insulation exposed to weather shall be suitable for outdoor service e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

SECTION ~~125~~120.5 – REQUIRED NONRESIDENTIAL MECHANICAL SYSTEM ACCEPTANCE

- (a) Before an occupancy permit is granted 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:
 - 1. Outdoor air ventilation systems shall be tested in accordance with NA7.5.1
 - 2. Constant volume, single zone unitary air conditioning and heat pump unit controls shall be tested in accordance with NA7.5.2.

3. Duct systems shall be tested in accordance with NA7.5.3 where either:
 - A. They are new duct systems that meet the criteria of Sections 140.4(kl)1, 140.4(kl)2, and 140.4(kl)3; or
 - B. They are part of a system that meets the criteria of Section 140.9141.0(b)1D.
4. Air economizers shall be tested in accordance with NA7.5.4.

EXCEPTION to Section 125120.5(a)4: Air economizers installed by the HVAC system manufacturer and certified to the Commission as being factory calibrated and tested are exempted from the Functional Testing section of the Air Economizer Controls acceptance test as described in not required to be field tested per NA7.5.4.2.
5. Demand control ventilation systems required by Section 121120.1(c)3 shall be tested in accordance with NA7.5.5
6. Supply fan variable flow controls shall be tested in accordance with NA7.5.6
7. Hydronic system variable flow controls shall be tested in accordance with NA7.5.7 and NA7.5.9
8. Boiler or chillers that require isolation controls per Section 140.4(jk)2 or 140.4(jk)3 shall be tested in accordance with NA7.5.7
9. Hydronic systems with supply water temperature reset controls shall be tested in accordance with NA7.5.8
10. Automatic demand shed controls shall be tested in accordance with NA7.5.10.
11. Fault Detection and Diagnostics (FDD) for Packaged Direct-Expansion Units shall be tested in accordance with NA7.5.11.
12. Automatic fault detection and diagnostics (FDD) for air handling units and zone terminal units shall be tested in accordance with NA7.5.12.
13. Distributed Energy Storage DX AC Systems shall be tested in accordance with NA7.5.13.
14. Thermal Energy Storage (TES) Systems shall be tested in accordance with NA7.5.14.
15. Supply air temperature reset controls shall be tested in accordance with NA7.5.15.
16. Water-cooled chillers served by cooling towers with condenser water reset controls shall be tested in accordance with NA7.5.16.
17. When an Energy Management Control System is installed to function as a thermostat for compliance with Title 24, Part 6, it shall functionally meet all of the applicable requirements of Section 110.2(c).

SECTION 120.6 – MANDATORY REQUIREMENTS FOR REFRIGERATED WAREHOUSES COVERED PROCESSES

(a) Mandatory Requirements for Refrigerated Warehouses

~~A refrigerated warehouse with total cold storage and frozen storage area of 3,000 square feet or larger shall meet the requirements of this section.~~

EXCEPTION 1 to Section 126: ~~A refrigerated space less than 3,000 square feet shall meet the Appliance Efficiency Regulations for walk-in refrigerators or freezers.~~

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).

EXCEPTION 2 to Section 126: Areas within refrigerated warehouses that are designed solely for the purpose of quick chilling or freezing of products with design cooling capacities of greater than 240 Btu/hr ft² (2 tons per 100 ft²).

(a)1. **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)~~ ~~TABLE 126 A-A~~.

TABLE 120.6-A-4 REFRIGERATED WAREHOUSE INSULATION

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

*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.

(b)2. **Underslab heating.** Electric resistance heat shall not be used for the purposes of underslab heating.

EXCEPTION to Section 120.6(ba)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.

(c)3. **Evaporators.** ~~New fan~~-powered evaporators used in coolers and freezers shall conform to the following:

1A. 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 rate in accordance with NEMA Standard MG 1-2006 at full load rating conditions.**

2B. 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 conditions.

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(ae)3B2: 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. Evaporators served by a single compressor without unloading capability.

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-ft² (2 tons per 100 ft²)).

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-ft² (2 tons per 100 ft²)).

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

~~1. Condensers for systems utilizing ammonia shall be evaporatively cooled.~~

~~2A. Design saturated C~~condensing temperatures for evaporative-cooled condensers ~~under design conditions, including but not limited to~~ and water-cooled condensers served by fluid coolers or cooling towers shall be less than or equal to:

~~Ai.~~ The design wetbulb temperature plus 20° F in locations where the design wetbulb temperature is less than or equal to 76° F; or

~~Bii.~~ The design wetbulb temperature plus 19° F in locations where the design wetbulb temperature is between 76° F and 78° F; or

~~Ciii.~~ 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, and/or process refrigeration cooling for other than a refrigerated space.

~~3B. Design saturated C~~condensing temperatures for air-cooled condensers ~~under design conditions~~ shall be less than or equal to the design drybulb temperature plus 10° F for systems serving frozen storage freezers and shall be less than or equal to the design drybulb temperature plus 15° F for systems serving ~~cold storage coolers.~~

EXCEPTION 1 to Section 120.6(a)4B: Unitary eCondensing 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.

~~4C.~~ 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 ~~condenser~~ fans serving a common condenser ~~loop-high side~~ in unison. The minimum condensing temperature setpoint shall be less than or equal to 70° F.

~~5D.~~ 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 ~~loop-high side~~ in unison. The minimum condensing temperature setpoint shall be less than or equal to 70° F, ~~or reset in response to ambient drybulb temperature or refrigeration system load.~~

~~6.~~ All single phase condenser fan motors less than 1 hp and less than 460 V shall be either permanent split capacitor or electronically commutated motors. 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.

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

<u>Condenser Type</u>	<u>Refrigerant Type</u>	<u>Minimum Efficiency</u>	<u>Rating Condition</u>
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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	<u>Ammonia</u>	75 Btuh/Watt	<u>105°F Saturated Condensing Temperature (SCT), 95°F Outdoor Drybulb Temperature</u>
	<u>Halocarbon</u>	65 Btuh/Watt	
<u>Indoor Air-Cooled</u>	All	Exempt	

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.

(e)5. Compressors. Compressor systems utilized in refrigerated warehouses shall conform to the following:

1A. Compressors shall be designed to operate at a minimum condensing temperature of 70° F or less.

2B. ~~The compressor speed of a~~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 greater than 50 hp shall control compressor speed be controllable in response to the refrigeration load ~~or the input power to the compressor shall be controlled to be less than or equal to 60 percent of full load input power when operated at 50 percent of full refrigeration capacity.~~

EXCEPTION 1 to Section 120.6(a)e5)2B: 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 its 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 ft² of opening size.

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:

(i) refrigerated display cases, or

(ii) 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

<u>Condenser Type</u>	<u>Minimum Specific Efficiency^a</u>	<u>Rating Condition</u>
<u>Evaporative-Cooled</u>	<u>160 (Btu/h)/W</u>	<u>100°F Saturated Condensing Temperature (SCT), 70°F Entering Wetbulb Temperature</u>
<u>Air-Cooled</u>	<u>65 (Btu/h)/W</u>	<u>105°F Saturated Condensing Temperature (SCT), 95°F Entering Drybulb Temperature</u>

^a See Section 100.1 for definition of condenser specific efficiency.

EXCEPTION 1 to Section 120.6(b)1E: Condensers with a THR capacity of less than 150 MBH 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)1A through F: New condensers replacing existing condensers when the attached compressor system Total Heat of Rejection does not increase and less than 25% 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 1 to Section 120.6(b)2B: Low temperature cascade systems that condense into another refrigeration system rather than condensing to ambient temperature.

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

3. Refrigerated Display Cases.

A. 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:

i. 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.

ii. Motion sensor controls on each case that reduce display case lighting power by at least 50% within 30 minutes after the area near the case is vacated.

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

B. Upright low temperature refrigerated display cases that are designed for a supply air temperature of 5°F or lower shall utilize reach-in glass doors.

4. Refrigeration Heat Recovery.

A. HVAC systems shall utilize heat recovery from refrigeration system(s) for space heating, using no less than 25% 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 HFC 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.

5. Commercial Refrigeration System Acceptance. Before an occupancy permit is granted for a new retail food store, or before a new refrigeration system serving a retail food store 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. Air-cooled condensers and fluid coolers shall be tested in accordance with NA7.14.1
- B. Evaporative condensers, fluid coolers and cooling towers shall be tested in accordance with NA7.14.2
- C. Compressor floating suction controls shall be tested in accordance with NA7.14.3
- D. Liquid subcooling shall be tested in accordance with NA7.14.4
- E. Display case lighting controls shall be tested in accordance with NA7.14.5
- F. Refrigeration heat recovery shall be tested in accordance with NA7.14.6

(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% 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% of design airflow.
3. CO shall be monitored with at least one sensor per 5,000 ft², 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 \leq 25 ppm at all times.
5. The ventilation rate shall be at least 0.15 cfm/ft² 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% of measurement.
 - B. Factory calibrated.
 - C. Certified by the manufacturer to drift no more than 5% 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 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% 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 for negative or zero pressure operation.

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.

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 input capacity 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% by volume on a dry basis over the entire firing range. Combustion air volume shall be controlled with respect to firing rate or 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 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% by volume on a dry basis over the entire firing range. Combustion air volume shall be controlled with respect to firing rate or 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 horsepower (hp) of the compressor(s) is 25 horsepower or more shall meet the requirements of Subsections 1 through 3.

1. **Trim Compressor and Storage.** The compressed air system shall be equipped with an appropriate sized trim compressor and primary storage to provide acceptable performance across the range of the system and to avoid control gaps. Compressed air systems with more than one compressor online 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. Single-compressor systems shall have a total effective trim capacity of no less than 30% of the rated compressor capacity. The system shall also include primary storage of at least 2 gallons per actual cubic feet per minute (acfm) of the largest net capacity increment.

EXCEPTION to Section 120.6(c)1: Compressed air systems in existing facilities that are altering less than 50% of the total capacity of the system.

2. **Controls.** Compressed air systems with more than one compressor online, having a combined horsepower rating of more than 100 hp, must operate with an approved 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.

SECTION 120.7 – ~~MANDATORY INSULATION REQUIREMENTS~~ ~~RESERVED~~

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

(a) **Roof Insulation.** The opaque portions of the roof that separate 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 framed walls that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 54 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 0.098.
3. **Light Mass Walls-** A minimum 6 inch Hollow Core Concrete Masonry Unit having a U-factor not to exceed 0.440.
4. **Heavy Mass Walls-** A minimum 8 inch Hollow Core Concrete Masonry Unit having a U-factor not to exceed 0.690.
45. **Wood Framed and Others-** The weighted average U-factor of the wall assembly shall not exceed 0.110.
- 6 **Glass 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-** 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.

SECTION 120.8 – ~~RESERVED~~. BUILDING COMMISSIONING

For all new nonresidential buildings, the elements listed below of building commissioning shall be included in the design and construction processes of the building project to verify that the building energy systems and components meet the owner's or owner representative's project requirements.. All building systems and components covered by Sections 110.0, 120.0, 130.0, and 140.0 shall be included in the scope of the commissioning requirements in this Section, excluding covered processes. For buildings less than 10,000 ft², only the design review requirements in Section 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 ft².

(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 system.

EXCEPTION to Section 120.8(c): Buildings less than 10,000 ft².

(d) Design Phase Design Review.

1. **Design Reviewer Requirements.** For buildings less than 10,000 ft², design phase design review may be completed by the design engineer. Buildings between 10,000 and 50,000 ft² 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 ft² 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;
2. Commissioning goals;
3. Systems to be commissioned.
4. Plans to test systems and components, which shall include:
 - A. An explanation of the original design intent;
 - B. Equipment and systems to be tested, including the extent of tests;
 - C. Functions to be tested;
 - D. Conditions under which the test shall be performed;
 - E. Measurable criteria for acceptable performance;
 - 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 ft².

(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 Construction Documents. 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. All Acceptance Requirements for Code Compliance shall be completed as part of this functional performance testing.

EXCEPTION to Section 120.8(g): Buildings less than 10,000 ft².

(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;
- B. Site contact information;
- C. Instructions for basic operations and maintenance, including general site operating procedures, basic troubleshooting, recommended maintenance requirements, and a site events log;
- D. Description of major systems;
- E. Site equipment inventory and maintenance notes;
- F. A copy of all special inspection verifications required by the enforcing agency or this code

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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 ~~it~~ 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 ft².

(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 ft².

SECTION 120.9 – RESERVED MANDATORY REQUIREMENTS FOR COMMERCIAL BOILERS.

(a) Combustion air positive shut-off shall be provided on all newly installed boilers as follows:

1. All boilers with an input capacity of 2.5 MMBtu/h (2,500,000 Btu/h) and above, in which the boiler is designed for negative or zero pressure operation.

2. All 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).

(b) Boiler combustion air fans with motors 10 horsepower or larger shall meet one of the following for newly installed boilers:

1. The fan motor shall be driven by a variable speed drive, or-

2. 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.

(c) Newly installed boilers with input capacity 5 MMBtu/h (5,000,000 Btu/h) and greater shall maintain excess (stack-gas) oxygen concentrations at less than or equal to 5.0% by volume on a dry basis over the entire firing range. Combustion air volume shall be controlled with respect to firing rate or flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited.

EXCEPTION to Section 120.9(c): Boilers with steady state full-load thermal efficiency 85% or higher.

130.0 to 134-130.5 NR Mandatory Lighting Controls and Building Power

SUBCHAPTER 4

NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL OCCUPANCIES—MANDATORY REQUIREMENTS FOR LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS

SECTION 130.0 – LIGHTING CONTROLS AND EQUIPMENT—GENERAL

- (a) Except as provided in Subsections (b) ~~and (e)~~, the design and installation of all lighting systems and equipment in nonresidential, high-rise residential, hotel/motel buildings, ~~and outdoor lighting, and electrical power distribution systems~~ subject to ~~Title 24~~, Part 6, shall comply with the applicable provisions of Sections ~~131-130.0~~ through ~~139-130.5~~. ~~All lighting controls and equipment shall be installed in accordance with the manufacturer's instructions.~~
- ~~(b) Indoor Lighting in High-rise Residential Dwelling Units and Hotel/Motel Guest Rooms. The design and installation of all lighting systems, lighting controls and equipment in high-rise residential dwelling units and in hotel/motel guest rooms shall comply with the applicable provisions of Section 150(k).~~
- ~~(c) Outdoor Lighting for High-rise Residential Dwelling Units and Hotel/Motel Guest Rooms. Outdoor lighting that is permanently attached to the building, and is separately controlled from the inside of a high-rise residential dwelling unit or guest room shall comply with Section 150(k)13.~~
- (b) Functional areas where compliance with the residential lighting Standards are required. The design and installation of all lighting systems, lighting controls, and equipment in the following functional areas shall comply with the applicable provisions of Section 150.0(k).**
- 1. High-rise residential dwelling units.**
 - 2. Outdoor lighting that is attached to a high-rise residential or hotel/motel building, and is separately controlled from the inside of a dwelling unit or guest room.**
 - 3. Fire station dwelling accommodations.**
 - 4. Hotel and motel guest rooms. Additionally, hotel and motel guest rooms shall meet the applicable requirements of Section 150.0(s).**
- ~~(d) Luminaire power. Luminaire wattage shall be determined as follows, or by a method approved by the Executive Director:~~
- (c) Luminaire classification and power. Luminaires shall be classified and wattage shall be determined as follows, or by a method approved by the Executive Director:**
- 1. The wattage of luminaires with line voltage lamp holders, other than GU-24 as determined according to Section 130(e), and not containing permanently installed ballasts or transformers shall be determined as follows:**
 - A. For other than recessed luminaires, the maximum relamping rated wattage of the luminaire, as listed on a permanent, pre-printed, factory-installed label, as specified by UL-1598.**
 - B. For recessed luminaires, the larger of the maximum relamping rated wattage of the luminaire, as listed on a permanent, pre-printed, factory-installed label, as specified by UL-1598, or the following:**

- i. ~~50 watts per socket for luminaires with housings or trims with an aperture diameter less than 5 inches regardless of mounting height; or~~
 - ii. ~~50 watts per socket for luminaires with housings or trims with an aperture diameter of greater than or equal to 5 inches and a mounting height of 11 feet or less; or~~
 - iii. ~~60 watts per socket for luminaires with housings or trims with an aperture diameter of greater than or equal to 5 inches and a mounting height of greater than 11 feet but less than 15 feet; or~~
 - iv. ~~75 watts per socket for luminaires with housings or trims with an aperture diameter of greater than or equal to 5 inches and a mounting height of 15 feet or more.~~
1. ~~Luminaires with line voltage lamp holders not containing permanently installed ballasts or transformers shall be determined as follows:~~
 - A. ~~Wattage of such luminaires shall be determined as follows:~~
 - i. ~~The maximum relamping rated wattage of the luminaire, as listed on a permanent, pre-printed, factory-installed label, as specified by UL 1598; and~~
 - ii. ~~For recessed luminaires with medium screw base sockets, wattage shall not be less than 50 watts per socket.~~
 - C. ~~For luminaires designed to accommodate a variety of trims or modular components that allow the conversion between screw-based and pin-based sockets without changing the luminaire housing or wiring, the highest wattage designated by the correlated marking on a permanent, pre-printed, factory-installed label on the luminaire housing shall be used.~~
 2. ~~Luminaires and luminaire housings designed to accommodate a variety of trims or modular components that allow the conversion between incandescent and any other lighting technology without changing the luminaire housing or wiring shall be classified as incandescent.~~
 3. ~~Screw-based adaptors shall not be used to convert an incandescent luminaire to any type of non-incandescent technology. Screw-based adaptors, including screw-base adaptors classified as permanent by the manufacturer, shall not be recognized for compliance with Part 6.~~
 4. ~~Luminaires and luminaire housings manufactured with incandescent screw base sockets shall be classified only as incandescent. Field modifications, including hard wiring of an LED module, shall not be recognized as converting an incandescent luminaire or luminaire housing to a non-incandescent technology for compliance with Part 6.~~
 - D. ~~For luminaires with line voltage lamp holders, the factory-installed wattage label shall not consist of peel-off or peel-down layers or other methods which allow the rated wattage to be changed after the luminaire has been shipped from the manufacturer.~~
 5. ~~For luminaires with medium screw-base sockets, the factory-installed wattage label shall not consist of peel-off or peel-down layers or other methods that allow the rated wattage to be changed after the luminaire has been shipped from the manufacturer.~~
 2. ~~The wattage of luminaires with permanently installed or remotely installed ballasts shall be the operating input wattage of the rated lamp/ballast combination published in manufacturer's catalogs based on independent testing lab reports as specified by UL 1598. The wattage of a compact fluorescent or high intensity discharge luminaire that can accommodate a range of wattages without changing the luminaire housing, ballast, or wiring shall be the larger of the installed wattage, or the average wattage of the lamp/ballast combinations for which the luminaire is rated.~~
 6. ~~Luminaires with permanently installed or remotely installed ballasts. The wattage of such luminaries shall be determined as follows:~~
 - A. ~~Wattage shall be the operating input wattage of the rated lamp/ballast combination published in ballast manufacturer's catalogs based on independent testing lab reports as specified by UL 1598.~~
 - B. ~~The wattage of a compact fluorescent or high intensity discharge luminaire that can accommodate a range of wattages without changing the luminaire housing, ballast, or wiring shall be the larger of:~~

- i. The wattage of the lamp/ballast combination determined in accordance with Section 130.0(c)2A when using the wattage of the initially installed lamp/ballast combination; or
 - ii. The average wattage of all of the lamp/ballast combinations for which the luminaire is rated; or
 - iii. As noted on a permanent, pre-printed, factory-installed label, as specific by UL.
- C. Replacement of lamps in a luminaire manufactured or rated for use with linear fluorescent lamps, with linear lamps of a different technology such as linear LED lamps, shall not be recognized as converting the fluorescent luminaire to a different technology for compliance with Part 6.
- ~~3. The wattage of line voltage lighting track and plug-in busway which allows the addition or relocation of luminaires without altering the wiring of the system shall be determined by one of the following methods:~~
7. Line-voltage lighting track and plug-in busway which allows the addition or relocation of luminaires without altering the wiring of the system. The wattage of such luminaires shall be determined by one of the following methods:
- A. The wattage of line voltage busway and track rated for more than 20 amperes shall be the total volt-ampere rating of the branch circuit feeding the busway and track.
 - B. The wattage of line voltage busway and track rated for 20 amperes or less shall be determined by one of the following methods:
 - i. The volt-ampere rating of the branch circuit feeding the track or busway; or
 - ii. The higher of the rated wattage of all of the luminaires included in the system, where wattage is determined according to Section 130.0(d)1, 2, 4, 5, or 6 as applicable, or 45 watts per linear foot; or
 - ~~iii. When using an integral current limiter, the higher of the volt-ampere rating of an integral current limiter controlling the track or busway, or 12.5 watts per linear foot of track or busway, provided that the integral current limiter complies with Section 119(l); or~~
 - iii. When using a line-voltage track lighting integral current limiter, the higher of the volt-ampere rating of an integral current limiter controlling the track or busway, or 12.5 watts per linear foot of track or busway. An Integral current limiter must be certified to the Energy Commission in accordance with Section 110.9, and shall comply with the Lighting Control Installation Requirements in accordance with Section 130.4, to qualify to use subsection B(iii) to determine luminaire power; or
 - ~~iv. When using a dedicated track lighting supplementary overcurrent protection panel, the sum of the ampere (A) rating of all of the overcurrent protection devices times the branch circuit voltages. The panel shall meet all of the following requirements:~~
 - ~~a. Be listed as defined in Section 101; and~~
 - ~~b. Be used only with line voltage track lighting; and~~
 - ~~c. Be permanently installed in an electrical equipment room, or permanently installed adjacent to the lighting panel board providing supplementary overcurrent protection for the track lighting circuits served by the supplementary over-current protection panel; and~~
 - ~~d. Be prominently labeled "NOTICE: This Panel for Track Lighting Energy Code Compliance Only. The overcurrent protection devices in this panel shall only be replaced with the same or lower amperage. No other overcurrent protective device shall be added to this panel. Adding to, or replacement of existing overcurrent protective device(s) with higher continuous ampere rating, will void the panel listing and require re-submittal and re-certification of California Title 24, Part 6 compliance documentation."~~
 - iv. When using a dedicated track lighting supplementary overcurrent protection panel, the sum of the ampere (A) rating of all of the overcurrent protection devices times the branch circuit voltages. Track lighting supplementary overcurrent protection panels shall comply with the applicable requirements in Section 110.9, and shall comply with the Lighting Control Installation Requirements in accordance with Section 130.4, to qualify to use subsection B(iv) to determine luminaire power.

- ~~4. The wattage of luminaires or lighting systems with permanently installed or remotely installed transformers shall be determined as follows:~~
- ~~A. The rated wattage of the lamp/transformer combination, listed on a permanent, pre-printed, factory-installed label, as specified by UL 2108; and~~
 - ~~B. For luminaires or lighting systems with transformers rated greater than 53 watts, the factory installed wattage label shall not consist of peel-off or peel-down layers or other methods which allow the rated wattage to be changed after the luminaire or lighting system has been shipped from the manufacturer.~~
- ~~8. Luminaires and lighting systems with permanently installed or remotely installed transformers. The wattage of such luminaires shall be determined as follows:~~
- ~~A. For low-voltage luminaires that do not allow the addition of lamps, lamp holders, or luminaires without rewiring, the wattage shall be the rated wattage of the lamp/transformer combination, listed on a permanent, pre-printed, factory-installed label, as specified by UL 2108.~~
 - ~~B. For low-voltage lighting systems, including low voltage tracks and other low-voltage lighting systems which allow the addition of lamps, lamp holders, or luminaires without rewiring, the wattage shall be the maximum rated input wattage of the transformer, listed on a permanent, pre-printed, factory-installed label, or maximum rated wattage published in transformer manufacturer's catalogs, as specified by UL 2108.~~
 - ~~C. For luminaires and lighting systems with the maximum rated transformer wattage greater than 53 watts, the factory-installed wattage label shall not consist of peel-off or peel-down layers or other methods which allow the rated wattage to be changed after the luminaire or lighting system has been shipped from the manufacturer.~~
- ~~5. The wattage of light emitting diode (LED) Luminaires, or LED Light Engine with Integral Heat Sink shall be the maximum rated input wattage of the system when tested in accordance with Reference Joint Appendix JA8. The maximum rated input wattage shall be listed on a permanent, pre-printed, factory installed label.~~
- ~~9. Light emitting diode (LED) Luminaires, and LED Light Engine. shall be determined as follows:~~
- ~~A. The wattage of such luminaires ~~Wattage~~ shall be the maximum rated input wattage of the system when tested in accordance with IES LM-79-08.~~
 - ~~B. The maximum rated input wattage shall be listed on a permanent, pre-printed, factory-installed label as specified by UL.~~
 - ~~C. An LED lamp, integrated or non-integrated type in accordance with the definition in ANSI/IES RP-16-2010, shall not be classified as a LED lighting system for compliance with Part 6. LED modules having screw-bases including screw based pig-tails, screw-based sockets, or screw-based adaptors shall not be recognized as a LED lighting system for compliance with Part 6.~~
 - ~~D. Luminaires and luminaire housings equipped with screw-base sockets shall not be classified as a LED lighting system for compliance with Part 6.~~
 - ~~E. Luminaires manufactured or rated for use with low-voltage incandescent lamps, into which have been installed LED modules or LED lamps, shall not be recognized as a LED lighting system for compliance with Part 6.~~
 - ~~F. For LED lighting systems which allow the addition of luminaires or light engines without rewiring, the wattage of such luminaires shall be the maximum rated input wattage of the power supply, listed on a permanent, pre-printed, factory-installed label, or published in the power supply manufacturer's catalog.~~
- ~~6. The wattage of all other miscellaneous lighting equipment shall be the maximum rated wattage of the lighting equipment, or operating input wattage of the system, listed on a permanent, pre-printed, factory-installed label, or published in manufacturer's catalogs, based on independent testing lab reports as specified by UL 1574 or UL 1598.~~
- ~~10. The wattage of all other miscellaneous lighting equipment shall be the maximum rated wattage of the lighting equipment, or operating input wattage of the system, listed on a permanent, pre-printed, factory-installed label, or published in manufacturer's catalogs, based on independent testing lab reports as specified by UL 1574 or UL~~

1598. Lighting technologies listed in subsections 1 through 9 shall be determined in accordance with the applicable requirements in subsections 1 through 9.

~~(e) GU 24 Lamps, Luminaires, and Adaptors. GU 24 lamps, luminaires, and adaptors installed in California shall meet the following requirements:~~

- ~~1. Lamps with GU 24 bases shall have a minimum efficacy no lower than specified in Table 150-C.~~
- ~~2. The wattage of luminaires with GU 24 lamp holders shall be the operating input wattage as listed on a permanent, pre-printed, factory-installed label on the luminaire housing, as specified by UL. Luminaires with GU 24 lampholders shall not be rated for any lamp or lighting system that has an efficacy lower than specified in Table 150-C.~~
- ~~3. Luminaires with GU 24 lampholders shall not have modular components allowing conversion to any lamp or lighting system that has an efficacy lower than specified in Table 150-C.~~
- ~~4. There shall be no adaptors that convert a GU 24 socket or GU 24 lamp holder to any other line voltage socket or lamp holder, or to any lighting system that has an efficacy lower than specified in Table 150-C.~~

(d) Lighting Controls. All lighting controls and equipment shall comply with the applicable requirements in Section 110.9, and shall be installed in accordance with the manufacturer's instructions.

SECTION 130.1 – INDOOR LIGHTING CONTROLS THAT SHALL BE INSTALLED

(a) Area Controls.

- ~~1. Each area enclosed by ceiling-height partitions shall have an independent switching or control device. This switching or control device shall be:

 - ~~A. Readily accessible; and~~
 - ~~B. Located so that a person using the device can see the lights or area controlled by that switch, or so that the area being lit is annunciated; and~~
 - ~~C. Manually operated, or automatically controlled by an occupant sensor that meets the applicable requirements of Section 119.~~~~

- ~~2. Other devices may be installed in conjunction with the switching or control device provided that they:

 - ~~A. Permit the switching or control device to manually turn the lights off in each area enclosed by ceiling-height partitions; and~~
 - ~~B. Reset the mode of any automatic system to normal operation without further action.~~~~

~~EXCEPTION 1 to Section 131(a): Up to 0.3 watts per square foot of lighting in any area within a building that must be continuously illuminated for reasons of building security or emergency egress, if:~~

- ~~A. The area is designated a security or emergency egress area on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Title 24, Part 1; and~~
- ~~B. The security or egress lighting is controlled by switches accessible only to authorized personnel.~~

~~EXCEPTION 2 to Section 131(a): Public areas with switches that is accessible only to authorized personnel.~~

1. All luminaires shall be functionally controlled with manually switched ON and OFF lighting controls. Each area enclosed by ceiling-height partitions shall be independently controlled.

EXCEPTION to Section 130.1(a)1: Up to 0.2 watts per square foot of lighting in any area within a building may be continuously illuminated during occupied times to allow for emergency egress, if:

- A. 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; and
- B. The egress lighting is not controlled by switches accessible to unauthorized personnel.

2. The lighting controls shall meet the following requirements:

- A. Shall be readily accessible; and
- B. Shall be operated with a manual switch that is located in the same room or area with the lighting that is controlled by that lighting control; and
- C. May be a dimmer switch that allows manual ON and OFF functionality.

EXCEPTION 1 to Section 130.1(a)2: In malls, auditoriums, retail and wholesale sales floors, industrial facilities, convention centers, and arenas, the lighting control shall be located so that a person using the lighting control can see the lights or area controlled by that lighting control, or so that the area being lit is annunciated.

EXCEPTION 2 to Section 130.1(a)2: Public restrooms having two or more stalls may use a captive key override or other manual switch not accessible to unauthorized personnel.

3. **Other Lighting Controls.** Other lighting controls may be installed in addition to the manual lighting controls provided they do not override the functionality of controls installed in accordance with Section 130.1(a)1, 2, or 4.
4. **Separately Controlled Lighting Systems.** In addition to the requirements in Section 130.1(a)1, 2, and 3:
 - A. General lighting shall be separately controlled from all other lighting systems in an area.
 - B. 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.
 - C. When track lighting is used, general, display, ornamental, and special effects lighting shall each be separately controlled.

~~(b) Multi-Level Lighting Controls. The general lighting of any enclosed space 100 square feet or larger, and has a connected lighting load that exceeds 0.8 watts per square foot, shall have multi-level lighting controls. Multi-level controls shall have at least one control step that is between 30 percent and 70 percent of design lighting power and allow the power of all lights to be manually turned off. A reasonably uniform level of illuminance shall be achieved by any of the following:~~

1. ~~Continuous or stepped dimming of all lamps or luminaires; or~~
2. ~~Switching alternate lamps in luminaires, alternate luminaires, and alternate rows of luminaires.~~

~~EXCEPTIONS to Section 131(b):~~

1. ~~Lights in corridors.~~
2. ~~A space that has only one luminaire with no more than two lamps.~~

(b) Multi-Level Lighting Controls. 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 following requirements:

1. Lighting shall have the required number of control steps and meet the uniformity requirements in accordance with Table 130.1-A; and
2. Lighting shall be controlled by manual controls in accordance with Section 130.1(a) and that are capable of controlling the lighting through all of the required control steps in accordance with Table 130.1-A; and
3. Multi-level lighting controls shall not override the functionality of other lighting controls that are installed for compliance with Sections 130.1(a), and (c through e); and
4. Each luminaire shall be controlled by at least of one of the following methods:
 - A. Manual dimming meeting the applicable requirements of Section 130.1(a)
 - 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 foot 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) Daylight Areas:~~

1. ~~Daylight areas shall be defined as follows:~~

~~A. DAYLIGHT AREA the total daylight area shall not double count overlapping areas with any primary sidelit daylight area, secondary sidelit daylight area, or skylit daylight area.~~

~~B. DAYLIGHT AREA, PRIMARY SIDELIT is the combined primary sidelit area without double counting overlapping areas. The floor area for each primary sidelit area is directly adjacent to vertical glazing below the ceiling with an area equal to the product of the sidelit width and the primary sidelit depth.~~

~~—The primary sidelit width is the width of the window plus, on each side, the smallest of:~~

- ~~i. 2 feet; or~~
- ~~ii. The distance to any 5 feet or higher permanent vertical obstruction.~~

~~The primary sidelit depth is the horizontal distance perpendicular to the glazing which is the smaller of:~~

- ~~i. One window head height; or~~
- ~~ii. The distance to any 5 feet or higher permanent vertical obstruction.~~

~~C. DAYLIGHT AREA, SECONDARY SIDELIT is the combined secondary sidelit area without double counting overlapping areas. The floor area for each secondary sidelit area is directly adjacent to primary sidelit area with an area equal to the product of the sidelit width and the secondary sidelit depth.~~

~~—The secondary sidelit width is the width of the window plus, on each side, the smallest of:~~

- ~~i. 2 feet; or~~
- ~~ii. The distance to any 5 feet or higher permanent vertical obstruction; or~~
- ~~iii. The distance to any skylit daylight area.~~

~~—The secondary sidelit depth is the horizontal distance perpendicular to the glazing which begins from one window head height, and ends at the smaller of:~~

- ~~i. Two window head heights;~~
- ~~ii. The distance to any 5 feet or higher permanent vertical obstruction; or~~
- ~~iii. The distance to any skylit daylight area.~~

~~D. DAYLIGHT AREA, SKYLIT is the combined daylight area under each skylight without double counting overlapping areas. The daylight area under each skylight is bounded by the rough opening of the skylight, plus horizontally in each direction the smallest of:~~

- ~~i. 70 percent of the floor to ceiling height; or~~
 - ~~ii. The distance to any primary sidelit area, or the daylight area under rooftop monitors; or~~
 - ~~iii. The distance to any permanent partition or permanent rack which is farther away than 70 percent of the distance between the top of the permanent partition or permanent rack and the ceiling.~~
- ~~2. Luminaires providing general lighting that are in or are partially in the skylit daylight area and/or the primary sidelit daylight area shall be controlled as follows:~~

~~A. Primary sidelit and skylit daylight areas shall have at least one lighting control that:~~

- ~~i. Controls at least 50 percent of the general lighting power in the primary sidelit and skylit daylight areas separately from other lighting in the enclosed space.~~
- ~~ii. Controls luminaires in primary sidelit areas separately from skylit areas.~~

~~EXCEPTION to Section 131(c) 2A: Primary sidelit and skylit daylight areas that have a combined area totaling less than or equal to 250 square feet within any enclosed space.~~

~~B. For all skylit daylight areas:~~

- ~~i. The skylit daylight area shall be shown on the plans.~~
- ~~ii. All of the general lighting in the skylit area shall be controlled independently by an automatic daylighting control device that meets the applicable requirements of Section 119.~~
- ~~iii. The automatic daylighting control shall be installed in accordance with Section 131(c)2D.~~

~~EXCEPTION 1 to Section 131(c)2B: Where the total skylit daylight area in any enclosed space is less than or equal to 2,500 square feet.~~

~~EXCEPTION 2 to Section 131(c)2B: Skylit daylight areas where existing adjacent structures obstruct direct beam sunlight for at least 6 hours per day during the equinox as calculated using computer or graphical methods.~~

~~EXCEPTION 3 to Section 131(c)2B: When the skylight effective aperture is greater than 4.0 percent, and all general lighting in the skylit area is controlled by a multi-level astronomical time switch that meets the requirements of Section 119(h) and that has an override switch that meets the requirements of Section 131(d)2.~~

~~EXCEPTION 4 to Section 131(c)2B: Skylit daylight areas where the effective aperture is less than 0.006. The effective aperture for skylit daylight areas is specified in Section 146(a)2E.~~

~~C. The primary sidelit area(s) shall be shown on the plans, and the general lighting in the primary sidelit areas shall be controlled independently by an automatic daylighting control device that meets the applicable requirements of Section 119 and is installed in accordance with Section 131(c) 2D.~~

~~EXCEPTION 1 to Section 131(c) 2C: Where the total primary sidelit daylight area in any enclosed space has an area less than or equal to 2,500 square feet.~~

~~EXCEPTION 2 to Section 131(c) 2C: Primary sidelit daylight areas where the effective aperture is less than 0.1. The effective aperture for primary sidelit daylight areas is specified in Section 146(a)2E.~~

~~EXCEPTION 3 to Section 131(c) 2C: Primary sidelit daylight areas where existing adjacent structures are twice as tall as their distance away from the windows.~~

~~EXCEPTION 4 to Section 131(c) 2C: Parking garages.~~

~~D. Automatic Daylighting Control Device Installation and Operation. Automatic daylighting control devices shall be installed and configured to operate according to all of the following requirements:~~

~~i. Automatic daylighting control devices shall have photosensors that are located so that they are not readily accessible in accordance with the designer's or manufacturer's instructions.~~

~~ii. The location where calibration adjustments are made to the automatic daylighting control device shall be readily accessible to authorized personnel, or located within 2 feet of a ceiling access panel that is no higher than 11 feet above floor level.~~

~~iii. Automatic daylighting controls shall be multi-level, including continuous dimming, and have at least one control step that is between 50 to 70 percent of rated power of the controlled lighting.~~

~~EXCEPTION 1 to Section 131(c) 2Diii:~~

~~Controlled lighting having a lighting power density less than 0.3 W/ft².~~

~~EXCEPTION 2 to Section 131(c)2Diii: When skylights are replaced or added to on an existing building with an existing general lighting system.~~

~~iv. Under all daylight conditions in all areas served by the controlled lighting, the combined illuminance from the controlled lighting and daylight is not less than the illuminance from controlled lighting when no daylight is available.~~

~~v. When all areas served by the controlled lighting are receiving daylight illuminance levels greater than 150 percent of the illuminance from controlled lighting when no daylight is available, the controlled lighting power consumption shall be no greater than 35 percent of the rated power of the controlled lighting.~~

(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. Separately controls for the lighting on each floor; and

C. Separately 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. Separately 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)2: 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 to Section 130.1(c)2: Single-stall bathrooms less than 40 square feet, and closets less than 40 square feet may use countdown timer switches with a maximum setting capability of five minutes.

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 which 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 provision in Section 130.2.

~~(d) Shut-off Controls.~~

- ~~1. In addition to the manual controls installed to comply with Sections 131(a) and (b), for every floor, all indoor lighting systems shall be equipped with separate automatic controls to shut off the lighting. These automatic controls shall meet the requirements of Section 119 and may be an occupant sensor, automatic time switch, or other device capable of automatically shutting off the lighting.~~

~~EXCEPTION 1 to Section 131(d)1: Where the lighting system is serving an area that must be continuously lit, 24 hours per day/365 days per year.~~

~~EXCEPTION 2 to Section 131(d)1: Lighting in corridors, guestrooms, dwelling units of high-rise residential buildings and hotel/motels, and parking garages.~~

~~EXCEPTION 3 to Section 131(d)1: Up to 0.3 watts per square foot of lighting in any area within a building that must be continuously illuminated for reasons of building security or emergency egress, provided that the area is designated a security or emergency egress area on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Title 24, Part 1.~~

- ~~2. If an automatic control device is installed to comply with Section 131(d)1, it shall incorporate an override switching device that:~~

~~A. Is readily accessible; and~~

~~B. Is located so that a person using the device can see the lights or the area controlled by that switch, or so that the area being lit is annunciated; and~~

~~C. Is manually operated; and~~

- ~~D. Allows the lighting to remain on for no more than 2 hours when an override is initiated; and~~
~~EXCEPTION to Section 131(d)2D: In malls, auditoriums, single tenant retail spaces, industrial facilities, and arenas, where captive key override is utilized, override time may exceed 2 hours.~~
- ~~E. Controls an area enclosed by ceiling height partitions not exceeding 5,000 square feet.~~
~~EXCEPTION to Section 131(d)2E: In malls, auditoriums, single tenant retail spaces, industrial facilities, convention centers and arenas, the area controlled may not exceed 20,000 square feet.~~
- ~~3. If an automatic time switch control device is installed to comply with Section 131(d)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 131(d)3: Retail stores and associated malls, restaurants, grocery stores, churches, and theaters.~~
- ~~4. 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. In addition, controls shall be provided that allow the lights to be manually shut off in accordance with Section 131(a) regardless of the sensor status.~~

(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 to 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 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 an automatic daylighting controls shall not be readily accessible to unauthorized personnel.
- ii. Automatic daylighting controls shall provide functional multi-level lighting, including continuous dimming, and have at least the number of control steps specified in Table 130.1-A.

EXCEPTION 1 to Section 130.1(d)2Dii: Controlled lighting having a lighting power density less than 0.3 W/ft^2 is not required to provide multi-level lighting controls.

EXCEPTION 2 to Section 130.1(d)2Dii: When skylights are replaced or added to an existing building where there is an existing general lighting system that is not being altered, multi-level lighting controls are not required.

- iii. For each space, the combined illuminance from the controlled lighting and daylight shall not be less than the illuminance from controlled lighting when no daylight is available.
- iv. In areas served by lighting that is daylight controlled, when the illuminance received from the daylight is greater than 150 percent of the illuminance received from the general lighting system, the general lighting power in that daylight zone shall be reduced by a minimum of 65 percent.

EXCEPTION 1 to Section 130.1(d)2: Rooms in which the combined total installed general lighting power in the Skylit Daylit Zone and Primary Sidelit Daylit Zone is less than 120 Watts.

EXCEPTION 2 to Section 130.1(d)2: Rooms which have a total glazing area of less than 24 square feet.

EXCEPTION 2 to Section 130.1(d)2: Parking garages complying with Section 130.1(d)3.

3. Parking Garage Daylighting Requirements. In a parking garage area with combined total of 36 square feet or more of glazing or opening, luminaires providing general lighting that are in the combined primary and secondary sidelit daylit zones shall be controlled independently by automatic daylighting controls, and shall meet the following requirements as applicable:

- A. All primary and secondary sidelit daylit zones shall be shown on the plans.
- B. Automatic Daylighting Control Installation and Operation. Automatic daylighting control shall be installed and configured to operate according to all of the following requirements:
 - i. Automatic daylighting controls shall have photosensors that are located so that they are not readily accessible to unauthorized personnel, and the location where calibration adjustments are made to the automatic daylighting controls shall not be readily accessible to unauthorized personnel.
 - ii. Automatic daylighting controls shall be multi-level, continuous dimming or ON/OFF.
 - ii. The combined illuminance from the controlled lighting and daylight is not less than the illuminance from controlled lighting when no daylight is available.
 - iv. When primary sidelit zones receive illuminance levels greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power consumption shall be zero.

EXCEPTION 1 to Section 130.1(d)3: Luminaires located in the daylight transition zone and luminaires for only dedicated ramps. Daylight transition zone and dedicated ramps are defined in Section 100.1.

EXCEPTION 2 to Section 130.1(d)3: The total combined general lighting power in the primary sidelit daylight zones is less than 60 watts

~~(e) Display Lighting. Floor and wall display, window display, and case display lighting shall each be separately switched on circuits that are 20 amps or less.~~

- ~~(f) Automatic Controls Required for Tailored Method. When the Tailored Method in Section 146 is used for calculating allowed indoor lighting power density, the general lighting shall be controlled separately from the display, ornamental, and display case lighting.~~
- ~~(g) Demand Responsive Lighting Controls. Demand responsive automatic lighting controls that uniformly reduce lighting power consumption by a minimum of 15 percent shall be installed in retail buildings with sales floor areas greater than 50,000 square feet.~~

~~EXCEPTION to Section 131(g): Buildings where more than 50 percent of the lighting power is controlled by daylighting controls.~~

~~**(e) Demand Responsive Controls.**~~

- ~~1. In buildings larger than 10,000 square feet, lighting required to comply with Section 130.1(b) shall be capable of being automatically reduced by a demand responsive lighting control as follows:~~
- ~~A. By a minimum of 15 percent of full power for continuous dimming systems; or~~
- ~~B. By one level below full ON in accordance with Table 130.1-A for stepped dimming or stepped switching.~~

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

<u>Luminaire Type</u>	<u>Minimum Required Control Steps (percent of full rated power¹)</u>				<u>Uniform level of illuminance shall be achieved by:</u>
<u>Line-voltage sockets except GU-24</u>	<u>Continuous dimming 10-100 percent</u>				
<u>Low-voltage incandescent systems</u>					
<u>LED luminaires and LED source systems</u>					
<u>GU-24 rated for LED</u>					
<u>GU-24 sockets rated for fluorescent > 20 watts</u>	<u>Continuous dimming 20-100 percent</u>				
<u>Pin-based compact fluorescent > 20 watts²</u>					
<u>GU-24 sockets rated for fluorescent < 20 watts</u>	<u>Minimum one step between 30-70 percent</u>				<u>Stepped dimming; or Continuous dimming; or Switching alternate lamps in a luminaire</u>
<u>Pin-based compact fluorescent < 20 watts²</u>					
<u>Linear fluorescent and U-bent fluorescent ≤ 13 watts</u>					
<u>Linear fluorescent and U-bent fluorescent > 13 watts</u>	<u>Minimum one step in each range:</u>				<u>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</u>
	<u>20-40 %</u>	<u>50-70 %</u>	<u>80-85 %</u>	<u>100 %</u>	

<p><u>Track Lighting</u></p>	<p><u>Minimum one step between 30 – 70 percent</u></p>	<p><u>Step dimming; or Continuous dimming; or Separately switching circuits in multi-circuit track with a minimum of two circuits.</u></p>
<p><u>HID > 20 watts</u></p>	<p><u>Minimum one step between 50 - 70 percent</u></p>	<p><u>Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner.</u></p>
<p><u>Induction > 25 watts</u></p>		
<p><u>Other light sources</u></p>		
<p><u>1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor</u> <u>2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps</u></p>		

SECTION 130.2 – OUTDOOR LIGHTING CONTROLS AND EQUIPMENT

- (a) **Outdoor Incandescent Lighting.** All ~~permanently installed~~ outdoor incandescent luminaires ~~employing lamps~~ rated over 100 watts, determined in accordance with Section 130.0(c)1, shall ~~either: have a lamp efficacy of at least 60 lumens per watt; or be controlled by a motion sensor.~~

~~EXCEPTION 1 to Section 132(a): Lighting required by a health or life safety statute, ordinance or regulation, including but not limited to emergency lighting.~~

~~EXCEPTION 2 to Section 132(a): Lighting used in or around swimming pools, water features or other locations subject to Article 680 of the California Electrical Code.~~

~~EXCEPTION 3 to Section 132(a): Searchlights.~~

~~EXCEPTION 4 to Section 132(a): Theme lighting for use in theme parks.~~

~~EXCEPTION 5 to Section 132(a): Lighting for film or live performances.~~

~~EXCEPTION 6 to Section 132(a): Temporary outdoor lighting.~~

~~EXCEPTION 7 to Section 132(a): Light emitting diode, light emitting capacitors, neon and cold cathode lighting.~~

~~EXCEPTION 8 to Section 132(a): Sign lighting~~

~~(b) **Luminaire Cutoff Requirements.** All outdoor luminaires that use lamps rated greater than 175 watts in hardscape areas including parking lots, building entrances, sales and non-sales canopies, and all outdoor sales areas shall be designated Cutoff for light distribution. To comply with this requirement, the luminaire shall be rated Cutoff in a photometric test report that includes any tilt or other non-level mounting condition of the installed luminaire. Cutoff is a luminaire light distribution classification where the candela per 1000 lamp lumens does not numerically exceed 25 at or above a vertical angle of 90 degrees above nadir, and 100 at or above a vertical angle of 80 degrees above nadir. Nadir is in the direction of straight down, as would be indicated by a plumb line. 90 degrees above nadir is horizontal. 80 degrees above nadir is 10 degrees below horizontal.~~

(b) **Luminaire Cutoff Requirements.** All outdoor luminaires rated for use with lamps greater than 150 lamp watts, determined in accordance with Section 130.0(c), shall comply with Backlight, Uplight, and Glare (collectively referred to as "BUG" in accordance with IES TM-15-11, Addendum A) requirements as follows:

A. There are no Backlight requirements in Section 130.2 of Part 6; and

B. Maximum zonal lumens for Uplight shall be in accordance with Table 130.2-A; and

C. Maximum zonal lumens for Glare shall be in accordance with Table 130.2-B.

EXCEPTION 1 to Section 130.2(b): Signs.

EXCEPTION 2 to Section 130.2(b): Lighting for building facades, public monuments, statues, and vertical surfaces of bridges.

EXCEPTION 3 to Section 130.2(b): Lighting ~~required not permitted to be by~~ cutoff by for compliance with a health or life safety statute, ordinance, or regulation to be a cutoff luminaire, including but not limited to, emergency lighting.

EXCEPTION 4 to Section 130.2(b): Temporary outdoor lighting.

~~**EXCEPTION 5 to Section 132(b):** Lighting used in or around swimming pools, water features, or other locations subject to Article 680 of the California Electrical Code.~~

EXCEPTION 65 to Section 130.2(b): Replacement of existing pole mounted luminaires in hardscape areas meeting all of the following conditions:

- A. Where the existing luminaire does not meet the luminaire cutoff requirements in Section 130.2(b); and
- B. Spacing between existing poles is greater than 6 times the mounting height of the existing luminaires; and

- C. Where no additional poles are being added to the site; and
- D. Where new wiring to the luminaires is not being installed; and
- E. Provided that the connected lighting power wattage is not increased.

(c) **Controls for Outdoor Lighting** Outdoor lighting controls shall be installed that meet the following requirements as applicable:

EXCEPTION 1 to Section 130.2(c): Outdoor lighting not permitted by to be turned OFF for compliance with a health or life safety statute, ordinance, or regulation to be turned OFF.

EXCEPTION 2 to Section 130.2(c): Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

- ~~1. All permanently installed outdoor lighting shall be controlled by a photocontrol or astronomical time switch that automatically turns off the outdoor lighting when daylight is available.~~

~~**EXCEPTION to Section 132(c)1:** Lighting in tunnels and large covered areas that require illumination during daylight hours.~~

1. All installed outdoor lighting shall be controlled by a photocontrol or outdoor astronomical time-switch control that automatically turns OFF the outdoor lighting when daylight is available.
2. For lighting of building facades, parking lots, sales and non-sales canopies, all outdoor sales areas, and student pick-up/drop-off zones where two or more luminaires are used, an automatic time switch shall be installed that is capable of (1) turning off the lighting when not needed and (2) reducing the lighting power (in watts) by at least 50 percent but not exceeding 80 percent or providing continuous dimming through a range that includes 50 percent through 80 percent reduction. This control shall meet the requirements of Section 119(c).

~~**EXCEPTION 1 to Section 132(c)2:** Lighting required by a health or life safety statute, ordinance, or regulation, including but not limited to, emergency lighting.~~

~~**EXCEPTION 2 to Section 132(c)2:** Lighting for steps or stairs that require illumination during daylight hours.~~

~~**EXCEPTION 3 to Section 132(c)2:** Lighting that is controlled by a motion sensor and photocontrol.~~

~~**EXCEPTION 4 to Section 132(c)2:** Lighting for facilities that have equal lighting requirements at all hours and are designed to operate continuously.~~

~~**EXCEPTION 5 to Section 132(c)2:** Temporary outdoor lighting.~~

~~**EXCEPTION 6 to Section 132(c)2:** Signs.~~

2. All installed outdoor lighting shall be circuited and controlled to turn OFF independently from other electrical loads.
3. All installed outdoor lighting where the bottom of the luminaire is mounted 24 feet or less above the ground, shall be controlled with motion sensors. The motion sensor shall be capable of automatically reducing the lighting power of each luminaire by at least 40 percent but not exceeding 80 percent, or provide continuous dimming through a range that includes 40 percent through 80 percent, and shall employ auto-ON functionality. No more than 1,500 watts of lighting power shall be controlled together.

EXCEPTION 1 to Section 130.2(c)3: Lighting for Outdoor Sales Frontage, Outdoor Sales Lots, and Outdoor Sales Canopies complying with Section 130.2(c)4.

EXCEPTION 2 to Section 130.2(c)3: Lighting for Building Facades, Ornamental Hardscape and Outdoor Dining complying with Section 130.2(c)5.

EXCEPTION 3 to Section 130.2(c)3: Outdoor lighting, where luminaire rated wattage is determined in accordance with Section 130.0(c), and which meet one of the following conditions:

- A. Pole-mounted luminaires each with a maximum rated wattage of 75 watts; or
- B. Non-pole mounted luminaires each with maximum rated wattage of 30 watts; or
- C. Linear lighting with a maximum wattage of 4 watts per linear foot of luminaire.

EXCEPTION 4 to Section 130.2(c)3: Applications listed as Exceptions to Section 140.7(a) shall not be required to meet the requirements of Section 130.2(c)3.

4. For Outdoor Sales Frontage, Outdoor Sales Lots, and Outdoor Sales Canopies lighting, an automatic lighting control shall be installed that meets the following requirements:
 - A. A part-night outdoor lighting control as defined in Section 100.1; or
 - B. Motion sensors capable of automatically reducing lighting power by at least 40 percent but not exceeding 80 percent, and which have auto-ON functionality.
5. For Building Facade, Ornamental Hardscape and Outdoor Dining lighting, an automatic lighting control shall be installed that meets one or more of the following requirements:
 - A. A part-night outdoor lighting control as defined in Section 100.1; or
 - B. Motion sensors capable of automatically reducing lighting power by at least 40 percent but not exceeding 80 percent, and which have auto-ON functionality; or
 - C. A centralized time-based zone lighting control capable of automatically reducing lighting power by at least 50 percent.

EXCEPTION to Section 130.2(c)5: Outdoor wall mounted luminaires having a bilaterally symmetric distribution (typically referred to as "wall packs") where the bottom of the luminaire is mounted 24 feet or less above the ground shall comply with the applicable requirements in Section 130.2(c)3

Table 130.2-A Uplight Ratings (Maximum Zonal Lumens)

Secondary Solid Angle	Maximum Zonal Lumens per Outdoor Lighting Zone			
	OLZ 1	OLZ 2	OLZ 3	OLZ 4
Uplight High (UH) 100 to 180 degrees	10	50	500	1,000
Uplight Low (UL) 90 to <100 degrees	10	50	500	1,000

Table 130.2-B Glare Ratings (Maximum Zonal Lumens)

Glare Rating for Asymmetrical Luminaire Types (Type I, Type II, Type III, Type IV)				
Secondary Solid Angle	Maximum Zonal Lumens per Outdoor Lighting Zone			
	OLZ 1	OLZ 2	OLZ 3	OLZ 4
Forward Very High (FVH) 80 to 90 degrees	100	225	500	750
Backlight Very High (BVH) 80 to 90 degrees	100	225	500	750
Forward High (FH) 60 to <80 degrees	1,800	5,000	7,500	12,000
Backlight High (BH) 60 to <80 degrees	500	1,000	2,500	5,000

Glare Rating for Quadrilateral Symmetrical Luminaire Types (Type V, Type V Square)				
Secondary Solid Angle	Maximum Zonal Lumens per Outdoor Lighting Zone			
	OLZ 1	OLZ 2	OLZ 3	OLZ 4
Forward Very High (FVH) 80 to 90 degrees	100	225	500	750
Backlight Very High (BVH) 80 to 90 degrees	100	225	500	750
Forward High (FH) 60 to <80 degrees	1,800	5,000	7,500	12,000
Backlight High (BH) 60 to <80 degrees	1,800	5,000	7,500	12,000

SECTION 130.3 – SIGN LIGHTING CONTROLS

~~(a) Controls for All Signs. All signs with permanently connected lighting shall meet the requirements of Section 133 below:~~

~~(a) **Controls for Sign Lighting.** All sign lighting shall meet the requirements below as applicable:~~

- ~~1. **Automatic Time Switch Control.** All signs with permanently connected lighting shall be controlled with an automatic time switch control that complies with the applicable requirements of Section 119.~~
- ~~2. **Photocontrol or outdoor astronomical time switch control.** All outdoor signs shall be controlled with a photocontrol or outdoor astronomical time switch control.~~

~~EXCEPTION to Section 133(a)2: Outdoor signs in tunnels and large covered areas that require illumination during daylight hours.~~

~~1. **Indoor Signs.** All indoor sign lighting shall be controlled with an automatic time-switch control or astronomical time-switch control.~~

~~2. **Outdoor Signs.** Outdoor sign lighting shall meet the following requirements as applicable:~~

~~A. All outdoor sign lighting shall be controlled with a photocontrol and astronomical time-switch control.~~

~~**EXCEPTION to Section 130.3(a)2A:** Outdoor signs in tunnels, and signs in large permanently covered outdoor areas that must be intended to be continuously lit, 24 hours per day and 365 days per year.~~

~~3. **Dimming.** All outdoor signs shall be controlled with a dimmer that provides the ability to automatically reduce sign power by a minimum of 65 percent during nighttime hours.~~

~~B. All outdoor sign lighting that is ON both day and night shall be controlled with a dimmer that provides the ability to automatically reduce sign lighting power by a minimum of 65 percent during nighttime hours. Signs that are illuminated at night and for more than 1 hour during daylight hours shall be considered ON both day and night.~~

~~EXCEPTION 1 to Section 133(a)3: Signs that are illuminated for less than 1 hour per day during daylight hours.~~

~~EXCEPTION 2 to Section 133(a)3: Outdoor signs in tunnels and large covered areas that require illumination during daylight hours.~~

~~**EXCEPTION to Section 130.3(a)2B:** Outdoor signs in tunnels and large covered areas that are intended to be illuminated require even illumination both day and night.~~

~~EXCEPTION 3 to Section 133(a)3: Metal halide, high pressure sodium, cold cathode, and neon lamps used to illuminate signs or parts of signs.~~

~~EXCEPTION 4 to Section 133(a)3: Demand Responsive Electronic Message Center Control. An Electronic Message Center (EMC) having a new connected lighting power load greater than 15 kW shall have a control installed that is capable of reducing the lighting power by a minimum of 30 percent when receiving a demand response signal that is sent out by the local utility.~~

~~3. **Demand Responsive Electronic Message Center Control.** An Electronic Message Center (EMC) having a new connected lighting power load greater than 15 kW shall have a control installed that is capable of reducing the lighting power by a minimum of 30 percent when receiving a demand response signal that is sent out by the local electric utility.~~

~~EXCEPTION 5 to Section 133(a)4: EMCs required by a health or life safety statute, ordinance, or regulation, including but not limited to exit signs and traffic signs.~~

~~**EXCEPTION to Section 130.3(a)3:** Lighting for EMCs that is not permitted by by 30 percent for compliance with a health or life safety statute, ordinance, or regulation to be reduced by 30 percent.~~

SECTION 130.4 — ~~REQUIRED NONRESIDENTIAL LIGHTING CONTROL ACCEPTANCE AND INSTALLATION CERTIFICATE REQUIREMENTS~~

- (a) **Lighting Control Acceptance Requirements.** Before an occupancy permit is granted for a new building or ~~space~~area, or a new lighting system serving a building, ~~space~~area, or site is operated for normal use, ~~all~~ indoor and outdoor lighting controls serving the building, ~~space~~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 ~~Title 24~~, Part 1, that:
1. Certifies plans, specifications, installation certificates, and operating and maintenance information meet the requirements of Part 6.
 - ~~2. Certifies that automatic daylighting controls meet the applicable requirements of Section 119 and Section 131(c) 2D.~~
 - ~~3. Certifies that when a multi-level astronomical time switch is used to meet EXCEPTION 3 to Section 131(c)2B all general lighting in the skylit area is controlled by a multi-level astronomical time switch that meets the applicable requirements of Section 119 and that has an override switch that meets the requirements of Section 131(d)2.~~
 - ~~4. Certifies that lighting controls meet the requirements of Section 131(a) through Section 131(e), Sections 131(e) and (f), and Section 146(a)2 as applicable.~~
 - ~~5. Certifies that automatic lighting controls meet the applicable requirements of Section 119 and Section 131(d).~~
 - ~~6. Certifies that occupant sensors meet the applicable requirements of Section 119 and Section 131(d).7.~~
~~————— Certified that outdoor lighting controls meet the applicable requirements of Section 119 and Section 132.~~
 2. Completes the applicable procedures in 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 Nonresidential Appendix NA7.6.1
 4. Certifies that lighting shut-OFF controls comply with Section 130.1(c) and Nonresidential Appendix NA7.6.2
 5. Certifies that demand responsive controls comply with Section 130.1(e) and Nonresidential Appendix NA7.6.3
 6. Certifies that outdoor lighting controls comply with the applicable requirements of Section 130.2(c) and 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. Certificationes 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 Nonresidential Appendix NA7.7.1.
 2. Certificationes 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 Nonresidential Appendix NA7.7.2.
 3. Certificationes 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 Nonresidential Appendix NA7.7.3.
 4. Certificationes 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 Nonresidential Appendix NA7.7.4.

5. Certificationes that interlocked lighting systems used to serve an approved area comply with Section 140.6(a)1; and comply with Nonresidential Appendix NA7.7.5.
6. Certificationes that lighting controls installed to earn a lighting Power Adjustment Factor (PAF) comply with Section 140.6(a)2; and comply with Nonresidential Appendix NA7.7.6.
7. Certificationes that additional lighting wattage installed for a videoconference studio complies with Section 140.6(c)2Gvii; and complies with Nonresidential Appendix NA7.7.7.

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.

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.

(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(b) Buildings for which a complete metering and measurement system is provided that as a minimum measures and reports the loads called for in Table 130.5B.

(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. Controlled receptacles shall meet the following requirements:

1. Electric circuits serving controlled receptacles shall be equipped with automatic shut-OFF controls following the requirements prescribed in Section 130.1(c) for general lighting operating in the occupancy mode; 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 130.1(a)1, 2, and 3; and
5. 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 Response Signals.** Demand response signals shall conform to a standard in the National Institute of Standards and Technology (NIST) Smart Grid Interoperability Panel (SGIP) Catalog of Standards (CoS) and as approved by the Executive Director.

(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 meets the following minimum requirements:
 - A. Provides all applicable functionality for each thermostat, including two-stage, electronic, and setback thermostats in accordance with Sections 140.4 and 141.0
 - B. Complies with all applicable acceptance test requirements in accordance with Nonresidential Appendices NA 7.5.2 for each thermostat
 - C. 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

Meter 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
<u>Instantaneous (at the time) kW demand</u>	<u>Required</u>	<u>Required</u>	<u>Required</u>	<u>Required</u>
<u>Historical peak demand (kW)</u>	<u>Not required</u>	<u>Not required</u>	<u>Required</u>	<u>Required</u>
<u>Resettable kWh</u>	<u>Required</u>	<u>Required</u>	<u>Required</u>	<u>Required</u>
<u>kWh per rate period</u>	<u>Not required</u>	<u>Not required</u>	<u>Not required</u>	<u>Required</u>

TABLE 130.5-B MINIMUM REQUIREMENTS FOR SEPARATION OF ELECTRICAL LOAD

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

SECTION 136 – RESERVED

SECTION 137 – RESERVED

SECTION 138 – RESERVED

SECTION 139 – RESERVED

140.0 to 140.2 NR General Performance and Prescriptive

SUBCHAPTER 5

NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL OCCUPANCIES—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY

SECTION 140.0 – ~~CHOICE OF~~ PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

Nonresidential, high-rise residential and hotel/motel buildings shall meet all of the following:

1. ~~The requirements of Section 100.0 through 110.10 applicable to the building project (mandatory measures).~~
2. ~~The requirements of Section 120.0 through 130.5 (mandatory measures).~~
3. ~~Either the performance compliance approach (energy budgets) in Section 140.1 or the prescriptive compliance approach in Section 140.2 for the climate zone in which the building will be located. Climate zones are shown in FIGURE 100.1-A.~~

~~NOTE: The Commission periodically updates, publishes, and makes available to interested persons and local enforcement agencies precise descriptions of the climate zones, which is available by zip codes boundaries depicted in the Reference Joint Appendices along with a list of the communities in each zone.~~

~~The envelope and the space conditioning, lighting, and service water heating systems of all nonresidential, high-rise residential, and hotel/motel buildings subject to Title 24, Part 6, shall be designed, constructed, and installed in accordance with either:~~

- (a) ~~Performance Approach~~—~~to use no more TDV energy from depletable sources than the energy budget, calculated according to Section 140.1; or~~
- (b) ~~Prescriptive Approach~~—~~in accordance with all the applicable requirements of Sections 140.2 through 140.~~

SECTION 140.1 – PERFORMANCE APPROACH: ENERGY BUDGETS.

~~A building complies with the performance approach if the energy budget calculated for the Proposed Design Building under Subsection (b) is no greater than the energy budget calculated for the Standard Design Building under Subsection (a).~~

~~In order to meet the energy budget, a proposed building's use of TDV energy calculated under Subsection (b) must be no greater than the TDV energy budget calculated under Subsection (a).~~

- (a) ~~Energy Budget for the Standard Design Building.~~—~~The energy budget for a proposed building is determined by applying the mandatory and prescriptive requirements to the Proposed Design Building. The energy budget is the sum of the TDV energy for space-conditioning, indoor lighting, mechanical ventilation and service water heating. the sum of the space-conditioning, lighting, and service water heating budgets in Subdivisions 1, 2, and 3 of this subsection, expressed in Btu per square foot of conditioned floor area per year.~~

1. ~~**Space conditioning budget.** The space conditioning budget is the TDV energy used for space conditioning in a standard building in the climate zone in which the proposed building is located, calculated with a method approved by the Commission (expressed in TDV energy per square foot of conditioned floor area per year), and assuming that:~~
- ~~A. The standard building has space heating, space cooling, and ventilation systems that meet, but do not exceed, the minimum efficiency requirements of Sections 110.1 and 110.2, and the requirements of Section 140.4; and~~
 - ~~B. The performance of the roof/ceiling, walls, floors and soffits, windows, and skylights is equal to an applicable value using the same assembly type from TABLE 140.3-A, TABLE 140.3-B, or TABLE 140.3-C, and for nonresidential buildings with low-sloped roofs, the roof aged solar reflectance and thermal emittance is equal to the values specified in Section 118(i)1; and~~
 - ~~C. The zoning, the orientation of each building feature, and the gross envelope areas of the standard building are the same as in the proposed building; and~~
 - ~~D. The window area of the west-facing wall is the greater of: 1) the window area of the proposed building, excluding the window area in demising walls, or 40 percent of the gross exterior west-facing wall area of the standard building, whichever is less; or 2) 6 feet times the west-facing display perimeter; and the window area of the standard building is the greater of (1) or (2): (1) the window area of the proposed building excluding the window area in demising walls, or 40 percent of the gross exterior wall area of the standard building, whichever is less; or (2) 6 feet times the display perimeter; and~~
 - ~~E. For buildings subject to Section 143(e), the skylight area of the standard building shall be the minimum area required by Section 143(e). For all other buildings, the skylight area of the standard building is the same as in the proposed building, or is 5 percent of the gross exterior roof/ceiling area of the standard building, whichever is less.~~
2. ~~**Lighting budget.** The lighting budget is the TDV energy used for lighting in a standard building calculated with a method approved by the Commission (expressed in Btu per square foot of conditioned floor area per year), and assuming that:~~
- ~~A. The lighting power density of the standard building, for areas where no lighting plans or specifications are submitted for permit and the occupancy of the building is known, is the maximum allowed lighting power density calculated according to Section 146(e)1; and~~
 - ~~B. The lighting power density of the standard building, for areas where no lighting plans or specifications are submitted for permit, and the occupancy of the building is not known, is 1.2 watts per square foot; and~~
 - ~~C. The lighting power density of the standard building, for areas where lighting plans and specifications are being submitted for permit, is the maximum allowed lighting power density calculated according to Section 146(e) 1, 2, or 3; and~~
 - ~~D. The lighting power density of the standard building is adjusted as described in the Nonresidential ACM Manual for an astronomical timeclock when required by Section 131(e)2 for the presence of automatic daylighting controls in the secondary sidelit zones as required by Section 146(d).~~
3. ~~**Service water heating budget.** The service water heating budget is the TDV energy used for service water heating in a standard building in the climate zone in which the proposed building is located, calculated with a method approved by the Commission (expressed in Btu per square foot of conditioned floor area per year), and assuming that the standard building has a service water heating system that meets, but does not exceed, the applicable requirements of Sections 111, 113, 123, and 145.~~
- (b) ~~**TDV Energy Use of Budget for the Proposed Design Building.** The energy budget for a Proposed Design Building is determined by calculating the TDV energy for the Proposed Design Building. The energy budget is the sum of the TDV energy for space-conditioning, indoor lighting, mechanical ventilation and service water heating.~~

The TDV energy use of a proposed building is the sum of the space conditioning, lighting, and service water heating TDV energy use calculated in Subdivisions 1, 2, and 3 of this subsection, using the same Compliance software used to calculate the budget under Subsection (a), and expressed in Btu per square foot of conditioned floor area per year. If any feature of the proposed building, including, but not limited to, the envelope or the space conditioning, lighting, or service water heating system, is not included in the building permit application, the energy performance of the feature shall be assumed to be that of the corresponding feature calculated in Subsection (a).

1. ~~Space conditioning TDV energy use.~~ The space conditioning TDV energy use shall be calculated by:
 - A. ~~Using a method approved by the Commission; and~~
 - B. ~~Using the proposed building's space heating, space cooling, lighting, and ventilation systems, roof and ceiling, walls, floors and soffits, opaque envelope areas, windows, skylights, zoning, and orientation, as shown on the plans and specifications submitted in the building permit application under Section 10-103 of Title 24, Part 1.~~
 2. ~~Lighting TDV energy use.~~ The lighting TDV energy use shall be calculated using a method approved by the Commission, and using the actual lighting power density calculated under Section 146(c), including reduction of wattage by the applicable lighting power adjustment factors specified in Section 146(a)2. The lighting power density shall also be adjusted as described in the Nonresidential ACM Manual for an astronomical timeclock when required by Section 131(c)2 the presence of automatic daylighting controls in the secondary sidelite zones as required by Section 146(d).
 3. ~~Service water heating TDV energy use.~~ The service water heating TDV energy use shall be calculated using a method approved by the Commission, and using the proposed building's actual service water heating system.
- (c) **Calculation of Energy Budget and Energy Use.** When calculating the energy budget under Subsection (a) and the TDV energy use under Subsection (b), all of the following rules shall apply: The TDV energy for both the Standard Design Building and the Proposed Design Building shall be computed by Compliance Software certified for this use by the Commission. The processes for Compliance Software approval by the Commission are documented in the Nonresidential ACM Approval Manual.
1. ~~Methodology.~~ The methodology, computer programs, inputs, and assumptions approved by the Commission shall be used.
 2. ~~Energy included.~~ All energy, from depletable sources and recovered from space conditioning equipment, used for space conditioning, lighting, and service water heating shall be included.
 3. ~~Energy excluded.~~ The following energy shall be excluded:
 - A. ~~Exempt process~~Process loads; and
 - B. ~~Loads of redundant or backup equipment, if the plans submitted under Section 10-103 of Title 24, Part 1, show controls that will allow the redundant or backup equipment to operate only when the primary equipment is not operating, and if such controls are installed; and~~
 - C. ~~Recovered energy other than from space conditioning equipment; and~~
 - D. ~~Additional energy use caused solely by outside air filtration and treatment for the reduction and treatment of unusual outdoor contaminants with final pressure drops more than 245 pascals or 1 inch water column. Only the energy accounted for by the amount of the pressure drop that is over 1 inch may be excluded.~~
 4. ~~U factors.~~ U factors shall be calculated as follows:
 - A. ~~All building components.~~ The U factor of all building components shall be calculated to three decimal places; the calculations shall assume still inside air and a 15 miles per hour outside air velocity, or other assumptions approved by the Commission.
 - B. ~~Wood framed assemblies.~~ U factors for wood framed assemblies shall be calculated using the parallel path method listed in ASHRAE Handbook, Fundamentals Volume, Chapter 23, with framing factors approved by the Commission.
 - C. ~~Metal framed assemblies.~~ U factors for metal framed assemblies shall be calculated using the zone method listed in ASHRAE Handbook, Fundamentals Volume, Chapter 23, or a method approved by the Commission.
 - D. ~~Fenestration.~~ U factors for fenestration shall be determined using NFRC 100 as specified in Section 116.
 - E. ~~Masonry assemblies.~~ U factors for masonry assemblies shall be calculated using the transverse isothermal planes method listed in ASHRAE Handbook, Fundamentals Volume, Chapter 23, or a method approved by the Commission.
 - F. ~~Other.~~ U factors for components not listed in this subsection shall be calculated using a method approved by the Commission.

5. ~~**Solar heat gain coefficients.** Solar heat gain coefficients shall be determined using NFRC 200 as specified in Section 146, and shall not be adjusted for the effects of interior or exterior shading devices.~~
6. ~~**Visible light transmittance.** Visible light transmittance shall be determined using the values listed in ASHRAE Handbook, Fundamentals Volume, Chapter 30, or manufacturers literature, and shall be adjusted for the effects of framing and interior or exterior shading devices.~~
- (d) ~~**Relocatable Public School Buildings.** When the manufacturer/builder certifies the relocatable public school building for use in any climate zone, the energy budget shall be met in the most severe climate zones as specified in the Nonresidential ACM Manual, assuming the prescriptive envelope criteria in TABLE 143-C. When the manufacturer/builder certifies that the relocatable building is manufactured for use in specific climate zones and that the relocatable building can not be lawfully used in other climate zones, the energy budget shall be met in each climate zone that the manufacturer/building certifies, assuming the prescriptive envelope criteria in TABLE 143-A, including the non-north window RSHG and skylight SHGC requirements for each climate zone. The energy budget and the energy use of the proposed building shall be determined using the multiple-orientation approach specified in the Nonresidential ACM Manual. The manufacturer/builder shall meet the requirements for identification labels specified in Section 143(a)8.~~

SECTION 140.2 – PRESCRIPTIVE APPROACH

In order to comply with the prescriptive approach under this section, a building shall be designed with and shall have constructed and installed:

- (a) A building envelope that complies with Section 140.3(a) or 140.3(b), and for applicable buildings Section 140.3(c);
- (b) A space-conditioning system that complies with Section 140.4;
- (c) A service water-heating system that complies with Section 140.5;
- (d) A lighting system that complies with Section 140.6;
- (e) An outdoor lighting system that complies with Section 140.7; ~~and~~
- (f) Interior and exterior signs that comply with Section 140.8; ~~and~~
- (g) Covered processes that comply with Section 140.9.

140.3 NR Prescriptive Envelope

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. ~~When making calculations under Subsection (a) or (b), all of the rules listed in Section 140.1(c)1, 4, and 5 shall apply.~~

(a) Envelope Component Approach.

1. Exterior roofs and ceilings. Exterior roofs and ceilings shall:

A. ~~Roofs. All r~~Roofing ~~P~~products ~~s~~ Shall meet the requirements of Section 110.8 and the applicable requirements of Subsections i through iii:

i. Nonresidential buildings:

~~a. with l~~Low-sloped roofs in climate zones ~~21 + 15 through 16~~ shall have a minimum ~~3-year~~ aged solar reflectance of ~~0.55-65~~ and a minimum thermal emittance of 0.75; or a minimum ~~aged~~ SRI of ~~6478~~.

EXCEPTION 1 TO SECTION 140.3(a)1Aia: Wood-framed roofs in climate zones 3 and 5 are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI 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 minimum requirements for solar reflectance and thermal emittance or SRI if the roof assembly has a U-factor of 0.048 or lower.

~~**EXCEPTION 3 TO SECTION 140.3(a)1Aia:** Roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are not required to meet the minimum requirements for solar reflectance and thermal emittance or SRI.~~

~~**EXCEPTION 4 TO SECTION 140.3(a)1Aia:** Roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft².~~ **EXCEPTION 3 TO SECTION 140.3(a)1Aia:** Roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft².

~~ii. b. Nonresidential. S~~steep-sloped roofs ~~with roofing products that have a roof weight of less than 5 pounds per square foot~~ in climate zones ~~21 through~~ 16 shall have a minimum ~~3-year~~ aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16. ~~Steep-sloped roofing products that have a roof weight of 5 pounds per square foot or more in climate zones 1 through 16 shall have a minimum 3-year aged reflectance of 0.15 and a minimum emittance of 0.75, or a minimum SRI of 10.~~

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

~~a. with l~~Low-sloped roofs in climate zones ~~10, 11, 13, 14, and 2 through~~ 15 shall have a minimum ~~3-year~~ aged solar reflectance of ~~0.55-65~~ and a minimum thermal emittance of 0.75; or a minimum SRI of ~~6478~~.

EXCEPTION TO SECTION 140.3(a)1Aia: Roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft²

b. Steep-sloped roofs 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.

EXCEPTION TO SECTION 140.3(a)1A: Roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are not required to meet the minimum requirements for solar reflectance, thermal emittance, or SRI.

B. ~~Have Roof Insulation placed in direct contact with a continuous roof or drywall ceiling where required by Section 118(e); and~~

~~Roofs shall C.—h~~ Have an overall assembly U-factor no greater than the applicable value in ~~TABLE 140.3-A~~ TABLE 140.3-B, ~~TABLE 140.3-B~~ TABLE 140.3-C, or ~~TABLE 140.3-C~~ TABLE 140.3-D, and shall be placed in direct contact with a continuous roof or drywall ceiling where required by Section 110.8(e).~~;~~

2. ~~Exterior walls~~ Walls. Exterior walls shall have an overall assembly U-factor no greater than the applicable value in ~~TABLE 140.3-A~~ TABLE 140.3-B, ~~TABLE 140.3-B~~ TABLE 140.3-C, or ~~TABLE 140.3-C~~ TABLE 140.3-D.
3. ~~Demising walls~~ Walls. Demising walls shall meet the requirements of Section 110.8(f).
4. ~~External~~ Exterior Floors and Soffits. External floors and soffits shall have an overall assembly U-factor no greater than the applicable value in ~~TABLE 140.3-A~~ TABLE 140.3-B, ~~TABLE 140.3-B~~ TABLE 140.3-C, or ~~TABLE 140.3-C~~ TABLE 140.3-D.
5. ~~Windows~~ Fenestration. ~~Windows~~ Vertical Windows shall:
 - A. Have (1) a west-facing area no greater than 40 percent of the gross west-facing exterior wall area, or 6 feet times the west-facing display perimeter, whichever is greater; and (2) a total area no greater than 40 percent of the gross exterior wall area, or 6 feet times the display perimeter, whichever is greater; and

EXCEPTION to Section 140.3(a)5A: Window area in demising walls is not counted as part of the window area for this requirement. Demising wall area is not counted as part of the gross exterior wall area or display perimeter.

B. Have ~~an area-weighted average a~~ U-factor no greater than the applicable value in ~~TABLE 140.3-A~~ TABLE 140.3-B, ~~TABLE 140.3-B~~ TABLE 140.3-C, or ~~TABLE 140.3-C~~ TABLE 140.3-D.

EXCEPTION to Section 140.3(a)5B: For Fenestration containing dynamic glazing, the lowest-rate labeled U-factor shall be used to demonstrate compliance with this section. Dynamic glazing shall be considered separately from other fenestration and area-weighted averaging with other fenestration that is not dynamic shall not be permitted.~~;~~ and

- C. Have ~~an area-weighted average~~ Relative Solar Heat Gain ~~Coefficient, RSHGC,~~ excluding the effects of interior shading, no greater than the applicable value in ~~TABLE 140.3-A~~ TABLE 140.3-B, ~~TABLE 140.3-B~~ TABLE 140.3-C, or ~~TABLE 140.3-C~~ TABLE 140.3-D. The relative solar heat gain of windows is:
 - i. The solar heat gain coefficient of the windows; or
 - ii. Relative solar heat gain as calculated by ~~Equation~~ EQUATION 140.3-A, if ~~an~~ the overhang extends beyond both sides of the window jamb ~~and meets~~ a distance equal to the overhang ~~horizontal~~ projection.

~~For fins, the fin projection is at least equal to the overhang projection, the fin offset is at least equal to the overhang offset and the fin extends from at least the sill to the head of the window.~~

EXCEPTION 1 to Section 140.3(a)5C: The applicable "north" value for ~~A~~ an area-weighted average Relative Solar Heat Gain of ~~in~~ TABLE 140.3-A, TABLE 140.3-B, or TABLE 140.3-C ~~TABLE 140.3-D~~ or 0.56, whichever is greater, or less shall be used for windows:

- a. That are in the first story of exterior walls that form a display perimeter; and
- b. For which codes restrict the use of overhangs to shade the windows.

EXCEPTION 2 to Section 140.3(a)5C: For Fenestration containing dynamic glazing, the lowest-rated labeled SGHC shall be used to demonstrate compliance with this section. Dynamic glazing shall be

considered separately from other fenestration and area-weighted averaging with other fenestration that is not dynamic shall not be permitted.

D. Have an area-weighted average Visible Transmittance, VT, no less than the applicable value in TABLE 143-B, TABLE 143-C and TABLE 143-D, or shall have a VT determined in accordance within the scope of NFRC 200; or ASTM E972 or Equation 140.3-B.

EXCEPTION 1 to Section 140.3(a)5D: When the vertical fenestration primary and secondary sidelit daylight zones are completely overlapped by a skylit daylight zones.

EXCEPTION 2 to Section 140.3(a)5D: If the fenestration visible transmittance is not within the scope of NFRC 200 or ASTM E972, the VT shall be calculated according to Reference Nonresidential Appendix NA6.

EXCEPTION 3 to Section 140.3(a)5D: When the fenestration containing dynamic glazing, the highest-rated labeled VT shall be used to demonstrate compliance with this section. Dynamic glazing shall be considered separately from other fenestration and area-weighted averaging with other fenestration that is not dynamic shall not be permitted.

EQUATION 140.3-A RELATIVE SOLAR HEAT GAIN

$$RSHG = SHGC_{win} \times \left[1 + \frac{aH}{V} + b \left(\frac{H}{V} \right)^2 \right]$$

WHERE:

RSHG = Relative solar heat gain.

SHGC_{win} = Solar heat gain coefficient of the window.

H = Horizontal projection of the overhang from the surface of the window in feet, but no greater than V.

V = Vertical distance from the window sill to the bottom of the overhang in feet.

a = -0.41 for north-facing windows, -1.22 for south-facing windows, and -0.92 for east and west-facing windows.

b = 0.20 for north-facing windows, 0.66 for south-facing windows, and 0.35 for east and west-facing windows.

~~the Prescriptive VT value is not met the Effective Aperture may be used when the minimum overall Effective Aperture is 0.11 or greater as determined by Equation 140.3-B.~~

~~If the Total Visible Transmittance performance value is not available it shall be calculated by using the manufacturers center of glass alone performance value in EQUATION 140.3-C. 1A Minimum Effective Aperture Classic of 0.11.~~

~~*EQUATION 140.3-B VERTICAL FENESTRATION MINIMUM VTEFFECTIVE APERTURE*~~

~~$$EFFECTIVE APERTURE-VT \geq 0.11 / WWR \times VT$$~~

~~WHERE~~Where:

~~WWR~~ = ~~A Maximum of 40% WWR. The window Wall Ratio is the total window area to the total gross exterior wall area for the entire building.~~

~~VT~~ = ~~Visible Transmittance of framed window.~~

~~EQUATION 140.3 C – VISIBLE TRANSMITTANCE OF CENTER OF GLASS CALCULATION~~

~~$$VT_T = VT_F \times VT_C$$~~

~~— WHERE:~~

- ~~VT_T = Is the Total Performance of the fenestration including glass and frame~~
- ~~VT_F = 0.53 for operable projecting windows, such as casement and awning windows~~
- ~~VT_F = 0.67 for operable windows~~
- ~~VT_F = 0.77 for fixed or non-operable windows~~
- ~~VT_F = $VT_F = 0.88$ for curtain wall/storefront, Site-built and manufactured non-curb mounted skylights~~
- ~~$VT_F = 1.0$ for Curb Mounted manufactured Skylights,~~
- ~~VT_C = Is the performance value for the center of glass alone~~

~~6.— Skylights. Skylights shall:~~

- ~~A. Have an area no greater than 5 percent of the gross exterior roof area; and~~

EXCEPTION to Section 140.3(a)6A: Atria over 55 feet high shall have a skylight area no greater than 10 percent of the gross exterior roof area.

- ~~B. Have an Area-Weighted Performance Rating U-factor no greater than the applicable value in TABLE 140.3-A TABLE 140.3-B, TABLE 140.3-B TABLE 140.3-C, or TABLE 140.3-C TABLE 140.3-D; and~~
- ~~C. Have an Area-Weighted Performance Rating solar heat gain coefficient no greater than the applicable value in TABLE 140.3-A TABLE 140.3-B, TABLE 140.3-B TABLE 140.3-C, or TABLE 140.3-C TABLE 140.3-D; and-~~
- ~~D. Have an Area-Weighted Performance Rating VT no less than the applicable value in TABLE 143-A TABLE 140.3-B, or TABLE 140.3-C.~~
- ~~E. 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 other test method approved by the Commission.~~
- ~~7. **Opaque Exterior doors.** All exterior doors that separatefor conditioned space from unconditioned space or ambient airs shall have a U-factor not greater than the applicable value in TABLE 140.3-A TABLE 140.3-B, TABLE 140.3-B TABLE 140.3-C, or TABLE 140.3-C TABLE 140.3-D. Doors that are more than one-half glass in area are considered Glazed Doors. -~~
- ~~8. **Relocatable Public School Buildings.** In complying with Sections 140.3(a)1 to 7, relocatable public school buildings shall comply either with TABLE 140.3-A TABLE 140.3-B, including the non-north window RSHG and skylight SHGC requirements, when the manufacturer/builder certifies that the relocatable building is manufactured only for use in a specific climate zone(s) and that the relocatable building cannot be lawfully used in other climate zones or with TABLE 140.3-C TABLE 140.3-D when the manufacturer/builder certifies that the relocatable building is manufactured for use in any climate zone. When the relocatable building complies with TABLE 140.3-C TABLE 140.3-D for use in more than one climate zone, the relocatable building shall meet the most stringent requirements for each building component in all of the climate zones for which the relocatable building is certified.~~

The manufacturer/builder shall place 2 metal identification labels on each relocatable building module, 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. In addition to information required by the Division of the State Architect (DSA), the labels shall state either "Complies with Title 24, Part 6 for all Climate Zones" or "Complies with Title 24, Part 6 for Climate Zones" and then list all of the climate zones for which the manufacturer has manufactured the relocatable building to comply. The location of the identification labels shall be shown on the building plans.

9. **Air Barrier.** To meet the requirement of Table 140.3-A, the building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of, the conditioned space. The air barrier shall be securely installed and sealed at all joints for its entire length using one of the following:

A. Individual materials that have an air permeance not exceeding 0.004 cfm/ft² under a pressure differential of 0.3 in. w.g. (1.57 psf) (0.02 L/m² at 75 pa) when tested in accordance with ASTM E2178; or

B. Assemblies of materials and components that have an average air leakage not to exceed 0.04 cfm/ft² under a pressure differential of 0.3 in. w.g (1.57 psf) (0.2 L/m² at 75 pa) when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680 or ASTM E283; or

EXCEPTION to Section 110.7(b)2B: Materials in TABLE 140.3-A below shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

TABLE 140.3-A MATERIALS DEEMED TO COMPLY AS AIR BARRIER

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

C. Testing the completed building and demonstrating that the air leakage rate of the building envelope does not exceed 0.40 cfm/ft² at a pressure differential of 0.3 in w.g. (1.57 psf) (2.0 L/ m² at 75 pa) in accordance with ASTM E779 or an equivalent approved method.

EXCEPTIONS to Section 110.7(b)2C:

1. Concrete masonry walls which have two coatings of paint or sealer coating.
2. Concrete masonry walls with integral rigid board insulation.
3. Structurally Insulated Panels.
4. Portland cement/sand parge, stucco, or plaster minimum 1/2 inch.

EXCEPTION to Section 140.3(a)9: Relocatable Public School Buildings.

TABLE 140.3-A-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	
Envelope	Insulation	Roofs/ Ceilings	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	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	0.039
		Walls	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	0.061	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	0.062
			Mass Light ¹	0.196	0.170	0.278	0.227	0.44	0.44	0.44	0.44	0.44	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass Heavy ¹	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	0.184	0.160
			Wood-framed and Other	0.102	0.059	0.110	0.059	0.102	0.110	0.110	0.102	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.042	0.059
	Floors/ Soffits	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	0.092	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	0.039	
	Roofing Products	Low-sloped	Aged Solar Reflectance	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	
			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	0.75	0.75
		Steep-Sloped	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	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	0.75	0.75
	Air Barrier			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ
Opaque Exterior Doors, U-factor	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		

	RSHG North	0 to < 10% WWR	0.72	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.72	
		10 to < 20% WWR	0.49	0.51	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.51	0.51	0.51	0.51	0.51	0.51	0.49
		20 to < 30% WWR	0.47	0.47	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.47	0.47	0.47	0.47	0.47	0.47	0.47
		30-40% WWR	0.47	0.47	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.47	0.47	0.47	0.47	0.40	0.40	0.47
	RSHG Non- North	0 to < 10% WWR	0.49	0.47	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.47	0.47	0.47	0.47	0.46	0.46	0.49	
		10 to < 20% WWR	0.43	0.36	0.55	0.55	0.55	0.61	0.61	0.61	0.61	0.36	0.36	0.36	0.36	0.36	0.36	0.43	
		20 to < 30% WWR	0.43	0.36	0.41	0.41	0.41	0.39	0.39	0.39	0.39	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.43
		30-40% WWR	0.43	0.31	0.41	0.41	0.41	0.34	0.34	0.34	0.34	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.43
Doors, U-factor	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	
Skylight	U-factor	Glass, curb	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	
		Glass, no-curb	0.68	0.68	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.68	0.68	0.68	0.68	0.68	0.68	0.68	
		Plastic	1.04	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.04

	SHGC	Glass, 0 to <2%	NR	0.46	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.46	0.46	0.46	0.46	0.46	0.46	NR	
		Glass, 2.1-5%	NR	0.36	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.36	0.36	0.36	0.36	0.36	0.36	NR
		Plastic, 0 to <2%	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
		Plastic, 2.1-5%	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57

Notes:

1. Mass, Light walls are defined as having a heat capacity greater than or equal to 7.0 Btu/h ft² and less than 15.0 Btu/h ft². Heavy mass walls are defined as having a heat capacity greater than or equal to 15.0 Btu/h ft².
2. No skylight SHGC requirements are defined for climate zones 1 and 16. A climate zone without a requirement is designated as "NR".
3. Closed-cell polyurethane foam insulation shall meet the procedure specified in Reference Appendices, RA3.5
4. Relocatable Public School Buildings are not subject to the requirements of Section 140.3(a)9.

Envelope	Fenestration	All Climate Zones					
			Fixed Window	Operable Window	Curtainwall/Storefront	Glazed Doors	
Vertical	Area-Weighted Performance Rating	Max U-factor	0.36	0.47	0.41	0.45	
		Max RSHG	0.25	0.22	0.26	0.23	
	Area-Weighted Performance Rating	Min VT	0.42	0.32	0.46	0.17	
	Max 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 RSHG	0.25	0.25	NR		
	Area-Weighted Performance Rating	Min VT	0.49	0.49	0.64		
Maximum SRR%	5%						

SECTION 140.3 – PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES

TABLE 140.3-B 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		
Envelope	Insulation	Roofs/ Ceilings	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	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		
		Walls	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	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	0.105	
			Mass Light ¹	0.170	0.170	0.170	0.107	0.107	0.227	0.227	0.227	0.196	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	
			Mass Heavy ¹	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	0.184	0.160	
	Floors/ Soffits	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	0.071	0.039	0.039	0.039	0.039	0.039	0.039	0.034	0.039	0.034			
	Roofing Products	Low-sloped	Aged Solar Reflectance	NR	NR0.65	0.550.65	0.550.65	0.550.65	NR0.65	0.550.65	0.550.65	0.550.65	NR								
			Thermal Emittance	NR	NR0.75	0.75	0.75	0.75	NR0.75	0.75	0.75	0.75	0.75	NR							
		Steep-Sloped	Aged Solar Reflectance	NR	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	NR								
Opaque Exterior Doors, U-factor		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
Vertical	Area-Weighted Performance Rating	Max U-factor	0.36	0.45	0.41	0.45
		Max RSHG	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	Area-Weighted Performance Rating		Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted	
		Max U-factor	0.58	0.46	0.88	
	Max RSHG	0.25	0.25	NR		
	Area-Weighted Performance Rating	Min VT	0.49	0.49	0.64	
	Maximum SRR%	5%				

Windows	U-factor		0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
	RSHG North	0 to < 10% WWR	0.68	0.49	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.49	0.49	0.49	0.49	0.47	0.47	0.68
		10 to < 20% WWR	0.68	0.49	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.49	0.49	0.49	0.49	0.43	0.43	0.68
		20 to < 30% WWR	0.47	0.40	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.40	0.40	0.40	0.40	0.43	0.43	0.47
		30-40% WWR	0.47	0.40	0.55	0.55	0.55	0.61	0.61	0.61	0.61	0.40	0.40	0.40	0.40	0.44	0.44	0.47
	RSHG Non-North	0 to < 10% WWR	0.46	0.36	0.44	0.44	0.44	0.47	0.47	0.47	0.47	0.36	0.36	0.36	0.36	0.36	0.36	0.46
		10 to < 20% WWR	0.46	0.36	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.36	0.36	0.36	0.36	0.34	0.34	0.46
		20 to < 30% WWR	0.36	0.31	0.31	0.31	0.31	0.36	0.36	0.36	0.36	0.31	0.31	0.31	0.31	0.26	0.26	0.36
		30-40% WWR	0.30	0.26	0.26	0.26	0.26	0.31	0.31	0.31	0.31	0.26	0.26	0.26	0.26	0.26	0.26	0.30

Doors, U-factor	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
Skylight	U-factor	Glass, curb	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
		Glass, no curb	0.68	0.68	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.68	0.68	0.68	0.68	0.68	0.68
		Plastic	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
SHGC	Glass, 0 to <2%	0.46	0.46	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.46	0.46	0.46	0.46	0.46	0.46	
	Glass, 2.1-5%	0.36	0.32	0.32	0.32	0.32	0.40	0.40	0.40	0.40	0.32	0.32	0.32	0.32	0.34	0.34	
	Plastic, 0 to <2%	0.69	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	
	Plastic, 2.1-5%	0.55	0.34	0.39	0.39	0.39	0.57	0.57	0.57	0.57	0.34	0.34	0.34	0.34	0.27	0.27	

Notes:

1. Mass, Light walls are defined as having a heat capacity greater than or equal to 7.0 Btu/h-ft² and less than 15.0 Btu/h-ft². Heavy mass walls are defined as having a heat capacity greater than or equal to 15.0 Btu/h-ft².

~~2. Closed cell polyurethane foam insulation shall meet the procedure specified in Reference Residential Appendices, RA3.5~~

~~TABLE 140.3-C~~ ~~TABLE 140.3-D~~ PRESCRIPTIVE ENVELOPE CRITERIA FOR RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE IN ALL CLIMATE ZONES

Roof Ceiling U-factor ¹	ALL CLIMATE ZONES
Metal Building	0.048
Wood-framed and other	0.039
Roofing Products – Aged Reflectance/Emittance	
	0.67555/0.75
	0.20/0.75
	0.15/0.75
Wall U-factor ¹	
Wood frame	0.059
Metal frame	0.062
Metal building	0.057
Mass/7.0 ≤ HC	0.170
Other	0.059
Floor/Soffit U-factor ¹	
Wood-Framed and Other	0.048
Windows	
U-factor	0.47
Relative S _{solar} H-heat gGain	
0-10% WWR	0.36
11-20% WWR	0.31
21-30% WWR	0.26
31-40% WWR	0.26
Glazed Doors	
Max Average Weighted U-factor	0.45
Max Average Weighted RSHG	0.23
Max Average Weighted VT	0.19
Opaque Exterior Doors, U-factor	
Non-Swinging	0.50
Swing	0.70
Skylights	

<i>U-factor</i>	<i>Glass w/Curb</i>	<i>0.99</i>
	<i>Glass wo/Curb</i>	<i>0.57</i>
	<i>Plastic w/Curb</i>	<i>0.87</i>
<i>SHGC Glass</i>	<i>0-2%</i>	<i>0.46</i>
	<i>2.1-5%</i>	<i>0.36</i>
<i>SHGC Plastic</i>	<i>0-2%</i>	<i>0.69</i>
	<i>2.1-5%</i>	<i>0.57</i>

Note: Construction assembly U-factors shall be calculated in accordance with Reference Joint Appendix JA4.

1. Closed-cell polyurethane foam insulation shall meet the procedure specified in Reference Residential Appendices, RA3.5

- (b) ~~Other Envelope Energy Tradeoff Approaches. Overall Other Envelope TDV Energy Tradeoff Approaches. Other envelope tradeoffs alternatives approved by the Executive Director may be allowed provided that the~~ The total TDV Energy of the overall envelope of the proposed building, TDV_{prop}, shall be no greater than the total TDV Energy of the overall envelope of a standard building, TDV_{std}, ~~as calculated in Reference Nonresidential Appendix NA5 "Envelope Tradeoff Procedure". In making the calculations, it shall be assumed that the orientation and area of each envelope component of the standard building are the same as in the proposed building. If the proposed building has Window Wall Ratio greater than 40 percent or Skylight Roof Ratio greater than 5 percent, the area of walls and windows or roofs and skylights will be adjusted accordingly in the standard building to cap the WWR at 40 percent and SRR at 5 percent.~~
- (c) **Minimum Skylight Area Daylighting Requirement for Large Enclosed Spaces in Buildings with Three or Fewer Stories.** In climate zones 2 through 15, ~~low rise~~ conditioned or unconditioned enclosed spaces that are greater than 85,000 ft² directly under a roof with ceiling heights greater than 15 feet shall meet ~~Sections 143(c)1-4 below~~ the following requirements:-
1. ~~Daylit Area.~~ At least one half of the floor area shall be in the skylit daylight area, the primary sidelit daylight area, or a combination of the skylit and primary sidelit daylight areas. The skylit and primary sidelit daylight areas shall be shown on the building plans. Skylit and primary sidelit daylight areas are defined in Section 131(e)1.
 2. ~~Minimum Skylight Area or Effective Aperture.~~ Areas that are skylit shall have a minimum skylight area to skylit area ratio of at least 3.3 percent or minimum skylight effective aperture of at least 1.1 percent. Skylight effective aperture shall be determined as specified in EQUATION 146-C. If primary sidelit area is used to comply with Section 143(c)1, the primary sidelit daylight areas shall have an effective aperture greater than 10 percent. The effective aperture for primary sidelit daylight areas is specified in Section 146(a)2E.
 1. A combined total of at least 75% of the floor area, in plan view, shall be within any of the following:
 - i. One head height from windows in a rectangular pattern, or
 - ii. 0.7 times the average ceiling height from the edge of rough opening of skylights in the identical shape of the skylight.
 2. All Skylit Daylit Zones and the 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).
- ~~346. Skylight Characteristics.~~ 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 other test method approved by the Commission; and
 - B. If the space is conditioned, meet the requirements in Section 140.3(a)6 or 140.3(b).
4. ~~Controls. Electric lighting in the daylit area shall be controlled as described in Section 131(e)2.~~
- 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 where it is planned to have less than or equal to 85,000 square feet of floor area, or ceiling heights less than or equal to 15 feet, based on proposed future interior wall and ceiling locations as delineated in the plans. This exception shall not apply to these future enclosed spaces when interior walls and ceilings are installed for the first time, the enclosed space floor area is greater than 85,000 square feet, and the ceiling height is greater than 15 feet (see Section 141.0.9(b)1M). 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.

140.4 to 140.5 NR Prescriptive Equipment

SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

A building complies with this section by being designed with and having constructed and installed a space-conditioning system that meets the requirements of Subsections (a) through (m).

- (a) **Sizing and Equipment Selection.** Mechanical heating and mechanical cooling equipment shall be 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 Subsection (b).

EXCEPTION 1 to Section 140.4(a): Where it can be demonstrated to the satisfaction of the enforcing agency that oversizing will not increase building TDV energy use.

EXCEPTION 2 to Section 140.4(a): Standby equipment with controls that allow the standby equipment to operate only when the primary equipment is not operating.

EXCEPTION 3 to Section 140.4(a): Multiple units of the same equipment type, such as multiple chillers and boilers, having combined capacities exceeding the design load, if they have controls that sequence or otherwise optimally control the operation of each unit based on load.

- (b) **Calculations.** In making equipment sizing calculations under Subsection (a), all of the following rules shall apply:
1. **Methodology.** The methodologies, computer programs, inputs, and assumptions approved by the Commission shall be used.
 2. **Heating and cooling loads.** Heating and cooling system design loads shall be determined in accordance with the procedures described in the ASHRAE Handbook, Fundamentals Volume, or as specified in a method approved by the Commission.
 3. **Indoor design conditions.** Indoor design temperature and humidity conditions for general comfort applications shall be determined in accordance with ASHRAE Standard 55 or the ASHRAE Handbook, Fundamentals Volume, Chapter 8, except that winter humidification and summer dehumidification shall not be required.
 4. **Outdoor design conditions.** Outdoor design conditions shall be selected from Reference Joint Appendix JA2, which is based on data from the ASHRAE Climatic Data for Region X. Heating design temperatures shall be no lower than the Heating Winter Median of Extremes values. Cooling design temperatures shall be no greater than the 0.5 percent Cooling Dry Bulb and Mean Coincident Wet Bulb values.
EXCEPTION to Section 140.4(b): Cooling design temperatures for cooling towers shall be no greater than the 0.5 percent Cooling Design Wet bulb values.
 5. **Ventilation.** Outdoor air ventilation loads shall be calculated using the ventilation rates required in Section 120.1.
 6. **Envelope.** Envelope heating and cooling loads shall be calculated using envelope characteristics, including square footage, thermal conductance, solar heat gain coefficient or shading coefficient, and air leakage consistent with the proposed design.
 7. **Lighting.** Lighting loads shall be based on actual design lighting levels or power densities as specified in Section 140.6.
 8. **People.** Occupant density shall be based on the expected occupancy of the building and shall be the same as determined under Section 120.1(b)2B, if used. Sensible and latent heat gains shall be as listed in the 2005 ASHRAE Handbook- Fundamentals, Chapter 30, Table 1.
 9. **Process loads.** Loads caused by a process shall be based upon actual information on the intended use of the building.
 10. **Miscellaneous equipment.** Equipment loads shall be calculated using design data compiled from one or more of the following sources:

- A. Actual information based on the intended use of the building; or
 - B. Published data from manufacturer's technical publications and from technical societies, such as the ASHRAE Handbook, Applications Volume; or
 - C. Other data based on the designer's experience of expected loads and occupancy patterns.
11. **Internal heat gains.** Internal heat gains may be ignored for heating load calculations.
12. **Safety factor.** Design loads may be increased by up to 10 percent to account for unexpected loads or changes in space usage.
13. **Other loads.** Loads such as warm-up or cool-down shall be calculated from principles based on the heat capacity of the building and its contents, the degree of setback, and desired recovery time; or may be assumed to be no more than 30 percent for heating and 10 percent for cooling of the steady-state design loads. The steady-state load may include a safety factor in accordance with Section ~~444~~140.4(b)12.
- (c) **Power Consumption of Fans.** Each fan system used for comfort space conditioning shall meet the requirements of Item 1 or 2 below, as applicable. Total fan system power demand equals the sum of the power demand of all fans in the system that are required to operate at design conditions in order to supply air from the heating or cooling source to the conditioned space, and to return it back to the source or to exhaust it to the outdoors; however, total fan system power demand need not include the additional power demand caused solely by air treatment or filtering systems with final pressure drops more than 245 pascals or one-inch water column (only the energy accounted for by the amount of pressure drop that is over 1 inch may be excluded), or fan system power caused solely by exempt process loads.
- 1. **Constant volume fan systems.** The total fan power index at design conditions of each fan system with total horsepower over 25 hp shall not exceed 0.8 watts per cfm of supply air.
 - 2. **Variable air volume (VAV) systems.**
 - A. The total fan power index at design conditions of each fan system with total horsepower over 25 hp shall not exceed 1.25 watts per cfm of supply air; and
 - ~~B. Individual VAV fans with motors 10 horsepower or larger shall meet one of the following:~~
 - ~~i. The fan motor shall be driven by a mechanical or electrical variable speed drive.~~
 - ~~ii. The fan shall be a vane axial fan with variable pitch blades.~~
 - ~~iii. For prescriptive compliance, 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 when static pressure set point equals 1/3 of the total design static pressure, based on certified manufacturer's test data.~~
 - CB. Static Pressure Sensor Location. Static pressure sensors used to control variable air volume fans shall be placed in a position such that the controller set point is no greater than one-third the total design fan static pressure, except for systems with zone reset control complying with Section ~~444~~140.4(c)2CD. If this results in the sensor being located downstream of major duct splits, multiple sensors shall be installed in each major branch with fan capacity controlled to satisfy the sensor furthest below its setpoint.
 - CD. Set Point Reset. For systems with direct digital control of individual zone boxes reporting to the central control panel, static pressure set point shall be reset based on the zone requiring the most pressure; i.e., the set point is reset lower until one zone damper is nearly wide open.
 - 3. **Air-treatment or filtering systems.** For systems with air-treatment or filtering systems, calculate the adjusted fan power index using Equation 140.4-A~~EQUATION 144 A~~:

EQUATION 144.4-A ADJUSTED FAN POWER INDEX

Adjusted fan power index = Fan power index x Fan Adjustment

$$\text{Fan Adjustment} = 1 - \left(\frac{\text{SP}_a - 1}{\text{SP}_f} \right)$$

WHERE:

SP_a = Air pressure drop across the air-treatment or filtering system.

SP_f = Total pressure drop across the fan.

4. **Fractional HVAC Motors for Fans.** ~~Fan motors of series fan-powered terminal units.~~ HVAC motors for fans that are ~~Fan motors of series fan-powered terminal units less than 1 hp or less and 1/12 hp or greater~~ 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. These motors shall also have the means to adjust motor speed for either balancing or remote control.

EXCEPTION 1 to Section 144(c)4: Motors in fan-coils and terminal units, including parallel fan-powered terminal units, that operate only when providing heating to the space served.

EXCEPTION 2 to Section 144(c)4: Motors installed in space conditioning equipment certified under Section 110.1 or 110.2.

- (d) **Space-conditioning Zone Controls.** Each space-conditioning zone shall have controls that prevent:

1. Reheating; and
2. Recooling; and
3. 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.

EXCEPTION 1 to Section 144(d): Zones served by variable air-volume systems that are designed and controlled to reduce, to a minimum, the volume of reheated, re-cooled, or mixed air supply are allowed only if the controls meet the following requirements:

- A. For each zone with direct digital controls (DDC):

- ~~i1.~~ The volume of primary air that is reheated, re-cooled, or mixed air supply shall not exceed the larger of:
 - a. 50 percent of the peak primary airflow, or
 - b. The design zone outdoor airflow rate per Section 120.1.
- ~~ii2.~~ The primary airflow in the deadband shall not exceed the larger of:
 - a. 20 percent of the peak primary airflow; or
 - b. The design zone outdoor airflow rate per Section 120.1.
- ~~iii3.~~ The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no larger than 95°F while the airflow is maintained at the dead band flow rate. Airflow between deadband and full heating or full cooling must be modulated.
- ~~iv.~~ The second stage of heating consists of modulating the airflow rate from the dead band flow rate up to the heating maximum flow rate.

- B. For each zone without DDC, the volume of primary airflow that is reheated, re-cooled, or mixed air supply shall not exceed the larger of the following:

- i1. 30 percent of the peak primary airflow; or
- ii2. The design zone outdoor airflow rate per Section 120.1.

EXCEPTION 2 to Section 144.140.4(d): Zones with special pressurization relationships or cross-contamination control needs.

EXCEPTION 3 to Section 144.140.4(d): 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.

EXCEPTION 4 to Section 144.140.4(d): Zones in which specific humidity levels are required to satisfy exempt or covered process ~~needs~~ loads. Computer Rooms or other spaces with only IT equipment may not use this exception.

EXCEPTION 5 to Section 144.140.4(d): Zones with a peak supply-air quantity of 300 cfm or less.

(e) **Economizers.**

1. Each individual cooling fan system that has a design ~~supply capacity over 2,500 cfm and a~~ total mechanical cooling capacity over ~~7554,000~~ Btu/hr shall include either:
 - A. An air economizer capable of modulating outside-air and return-air dampers to supply 100 percent of the design supply air quantity as outside-air; or
 - B. A 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 50°F dry-bulb/45°F wet-bulb and below.

EXCEPTION 1 to Section 144.140.4(e)1: Where it can be shown to the satisfaction of the enforcing agency that special outside air filtration and treatment, for the reduction and treatment of unusual outdoor contaminants, makes compliance infeasible.

EXCEPTION 2 to Section 144.140.4(e)1: Where the use of outdoor air for cooling will affect other systems, such as humidification, dehumidification, or supermarket refrigeration systems, so as to increase overall building TDV energy use.

EXCEPTION 3 to Section 144.140.4(e)1: Systems serving high-rise residential living quarters and hotel/motel guest rooms.

~~**EXCEPTION 4 to Section 144(e)1:** Where it can be shown to the satisfaction of the enforcing agency that the use of outdoor air is detrimental to equipment or materials in a space or room served by a dedicated space-conditioning system, such as a computer room or telecommunications equipment room.~~

~~**EXCEPTION 45 to Section 144(e)1:** Where electrically operated unitary air conditioners and heat pumps have cooling efficiencies that meet or exceed the efficiency requirements of TABLE 144-A and TABLE 144-B. For Where comfort cooling systems where have the cooling efficiency that meets or exceeds the cooling efficiency improvement requirements in TABLE 140.4-A.~~

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

<u>Climate Zone</u>	<u>Efficiency Improvement^a</u>
<u>1</u>	<u>155%</u>
<u>2</u>	<u>40%</u>
<u>3</u>	<u>75%</u>
<u>4</u>	<u>40%</u>
<u>5</u>	<u>50%</u>
<u>6</u>	<u>35%</u>
<u>7</u>	<u>25%</u>
<u>8</u>	<u>25%</u>
<u>9</u>	<u>25%</u>
<u>10</u>	<u>20%</u>
<u>11</u>	<u>30%</u>
<u>12</u>	<u>30%</u>
<u>13</u>	<u>30%</u>
<u>14</u>	<u>25%</u>
<u>15</u>	<u>10%</u>
<u>16</u>	<u>60%</u>

^a If a unit is rated with an IPLV, IEER or SEER then to eliminate the required air or water economizer, the 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 like EER or COP cooling then these must be increased by the percentage shown.

2. If an economizer is required by Section 140.4(c)1~~ubparagraph 1~~, it shall be:
 - A. Designed and equipped with controls so that economizer operation does not increase the building heating energy use during normal operation; and

EXCEPTION to Section ~~144~~140.4(e)2A: Systems that provide 75 percent of the annual energy used for mechanical heating from site-recovered energy or a site-solar energy source.
 - B. Capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.
3. Air economizers shall have high limit shutoff controls complying with TABLE ~~144 C~~140.4-B.

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

Device Type ^a	Climate Zones	Required High Limit (Economizer Off When):	
		Equation ^b	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	$T_{OA} > T_{RA}$	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 ^c + 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 ^c or Outdoor air temperature exceeds 75°F
Fixed Enthalpy ^a	4, 6, 7, 8, 9, 10 & 12	$h_{OA} > 28 \text{ Btu/lb}^{\text{b}}$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air ^b
Electronic Enthalpy	All	$(T_{OA} - RH_{OA}) > A$	Outdoor air temperature/RH exceeds the "A" set point curve ^e
Differential Enthalpy	All	$h_{OA} > h_{RA}$	Outdoor air enthalpy exceeds return air enthalpy

^a 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 are prohibited in all climate zones. **Fixed Enthalpy Controls are prohibited in climate zones 1, 2, 3, 5, 11, 13, 14, 15 & 16.**

^b 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.

^{b, c} 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 6000 foot elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.

^e Set point "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40% relative humidity and is nearly parallel to dry bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.

4. Air economizers and return air dampers on an individual cooling fan system that has a design supply capacity over 1,500 cfm and a total mechanical cooling capacity over 45,000 Btu/hr shall have the following features:

A. Warranty. 5-year performance warranty of economizer assembly.

B. Drive mechanism. Economizer and return dampers shall have a direct drive modulating actuator with either gear driven interconnections or tiebar and crossover side interconnections. The gear or linkage interconnections shall be located out of the airstream.

C. Damper reliability testing. Suppliers of economizers shall certify that their economizer assembly, including 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 100,000 damper opening and closing cycles.

D. Damper leakage. Economizer and return dampers shall be certified to have a maximum leakage rate of 10 cfm/sf at 1.0 in. w.g. when tested in accordance with AMCA Standard 500.

E. Adjustable setpoint. If the high-limit control is fixed dry-bulb, or fixed enthalpy it shall have an adjustable setpoint.

F. Damper control sensor location. Primary damper control temperature sensor shall be located after the cooling coil to maintain comfort.

G. **Sensor accuracy.** Outdoor air, return air and supply air sensors shall be calibrated within the following accuracies.

- i. **Drybulb and wetbulb temperatures accurate to ±1°F**
- ii. **Enthalpy accurate to within 1 Btu/lb**
- iii. **Relative humidity accurate to within 5%**

H. **Sensor calibration data.** Sensor calibration data of sensors used for control of economizer shall be plotted on sensor performance curve.

I. **Sensor high limit control.** Sensors used for the high limit control shall be located to prevent false readings, e.g. properly shielded from direct sunlight.

J. **Relief air system.** Relief air system shall be designed to provide up to 100% 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 the mechanical capacity control interlocked with the economizer controls such that the economizer is at 100% open position when mechanical cooling is on and does not begin to close until the leaving air temperature is less than 45 F.

B. 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. **>75,000 Btu/hr – Effective 1/1/2014**
- ii. **>65,000 Btu/hr – Effective 1/1/2016**

C. Effective 1/1/2014, all other DX units including those that control space temperature by modulating the airflow to the space shall comply with the requirements in Table 140.4-C. Controls shall not false load the mechanical cooling system by limiting or disabling the economizer or any means, such as hot gas bypass, except at the lowest stage of mechanical cooling capacity.

TABLE 140.4-C DIRECT EXPANSION UNIT REQUIREMENTS FOR COOLING STAGES AND COMPRESSOR DISPLACEMENT

<u>Cooling Capacity</u>	<u>Minimum Number of Mechanical Cooling Stages</u>	<u>Minimum Compressor Displacement</u>
<u>>65,000 Btu/h and <240,000 Btu/h</u>	<u>3 stages</u>	<u>≤35% full load</u>
<u>≥240,000 Btu/h</u>	<u>4 stages</u>	<u>≤25% full load</u>

(f) **Supply Air Temperature Reset Controls.** Mechanical space-conditioning systems supplying heated or cooled air to multiple zones shall include controls that automatically reset supply-air temperatures:

1. In response to representative building loads or to outdoor air temperature; and
2. By at least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

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.

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 144140.4(f): Where supply-air temperature reset would increase overall building energy use.

EXCEPTION 3 to Section 144140.4(f): Zones in which specific humidity levels are required to satisfy exempt process needs/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 144140.4(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.

EXCEPTION 2 to Section 144140.4(g): Where an electric-resistance heating system supplements a heat pump heating system, and the heating capacity of the heat pump is more than 75 percent of the design heating load calculated in accordance with Section 144140.4(a) at the design outdoor temperature specified in Section 144140.4(b)4.

EXCEPTION 3 to Section 144140.4(g): Where the total capacity of all electric-resistance heating systems serving the entire building is less than 10 percent of the total design output capacity of all heating equipment serving the entire building.

EXCEPTION 4 to Section 144140.4(g): Where the total capacity of all electric-resistance heating systems serving the entire building, excluding those allowed under Exception 2, is no more than 3 kW.

EXCEPTION 5 to Section 144140.4(g): Where an electric resistance heating system serves an entire building that is not a high-rise residential or hotel/motel building; and has a conditioned floor area no greater than 5,000 square feet; and has no mechanical cooling; and is in an area where natural gas is not currently available and an extension of a natural gas system is impractical, as determined by the natural gas utility.

(h) **Heat Rejection Systems.**

1. **General.** Subsection 144140.4(h) applies to heat rejection equipment used in comfort cooling systems such as air-cooled condensers, open cooling towers, closed-circuit cooling towers, and evaporative condensers.
2. **Fan Speed Control.** Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at 2/3 of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.

EXCEPTION 1 to Section 144140.4(h)2: Heat rejection devices included as an integral part of the equipment listed in TABLE 110.2-A through TABLE 110.2-E.

EXCEPTION 2 to Section 144140.4(h)2: Condenser fans serving multiple refrigerant circuits.

EXCEPTION 3 to Section 144140.4(h)2: Condenser fans serving flooded condensers.

EXCEPTION 4 to Section 144140.4(h)2: Up to 1/3 of the fans on a condenser or tower with multiple fans where the lead fans comply with the speed control requirement.

3. **Tower Flow Turndown.** Open cooling towers configured with multiple condenser water pumps shall be designed so that all cells can be run in parallel with the larger of:
 - A. The flow that's produced by the smallest pump; or
 - B. ~~33-50~~ percent of the design flow for the cell.
4. **Limitation on Centrifugal Fan Cooling Towers.** Open cooling towers with a combined rated capacity of 900 gpm and greater at 95°F condenser water return, 85°F condenser water supply and 75°F outdoor wet-bulb temperature shall use propeller fans and shall not use centrifugal fans.

EXCEPTION 1 to Section 144140.4(h)4: Cooling towers that are ducted (inlet or discharge) or have an external sound trap that requires external static pressure capability.

EXCEPTION 2 to Section 144140.4(h)4: Cooling towers that meet the energy efficiency requirement for propeller fan towers in Section 110.2, TABLE 110.2-G.

(i) **Minimum Chiller Efficiency.** Chillers shall meet or exceed Path B from Table 110.2D**EXCEPTION 1 to Section 144(i):** Chillers with electrical service > 600V.**EXCEPTION 2 to Section 144(i):** Chillers attached to a heat recovery system with a design heat recovery capacity > 40% of the design chiller cooling capacity.**EXCEPTION 3 to Section 144(i):** Chillers used to charge thermal energy storage systems where the charging temperature is < 40F.**EXCEPTION 4 to Section 144(i):** In plants with more than 3 chillers, only 3 chillers are required to meet the Path B efficiencies.(j) **Limitation of Air-Cooled Chillers**

1. Chilled water plants ~~with more than 300 tons total capacity~~ shall not have more than ~~100~~300 tons provided by air-cooled chillers.

EXCEPTION 1 to Section 144.4(j): Where the designer demonstrates that the water quality at the building site fails to meet manufacturer's specifications for the use of water-cooled equipment.**EXCEPTION 2 to Section 144.4(j):** ~~Plants that employ a cooling~~Chillers that are used to charge thermal energy storage system ~~with a design temperature of less than 40 degrees F (4 degrees C).~~**EXCEPTION 3 to Section 144.4(j):** Air cooled chillers with minimum efficiencies approved by the Commission pursuant to Section 10-109(d).(k) **Hydronic System Measures**

1. **Hydronic Variable Flow Systems.** HVAC chilled and hot water pumping shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to no more than the larger of: a) 50 percent or less of the design flow rate; or b) the minimum flow required by the equipment manufacturer for the proper operation of equipment served by the system.

EXCEPTION 1 to Section 144.4(k)1: Systems that include no more than three control valves.**EXCEPTION 2 to Section 144.4(k)1:** Systems having a total pump system power less than or equal to 1-1/2 hp.

2. **Chiller Isolation.** When a chilled water plant includes more than one chiller, provisions shall be made so that flow through any chiller is automatically shut off when that chiller is shut off while still maintaining flow through other operating chiller(s). Chillers that are piped in series for the purpose of increased temperature differential shall be considered as one chiller.
3. **Boiler Isolation.** When a hot water plant includes more than one boiler, provisions shall be made so that flow through any boiler is automatically shut off when that boiler is shut off while still maintaining flow through other operating boiler(s).
4. **Chilled and Hot Water Temperature Reset Controls.** Chilled and hot water systems with a design capacity exceeding 500,000 Btu/hr supplying chilled or heated water (or both) shall include controls that automatically reset supply water temperatures as a function of representative building loads or outside air temperature.

EXCEPTION to Section 144.4(k)4: Hydronic systems that use variable flow to reduce pumping energy in accordance with Section 144.4(k)1.
5. **Water -Cooled Air Conditioner and Hydronic Heat Pump Systems.** Water circulation systems serving water-cooled air conditioners, hydronic heat pumps, or both that have total pump system power exceeding 5 hp shall have flow controls that meet the requirements of Section 144.4(k)6. Each air conditioner or heat pump shall have a two-position automatic valve interlocked to shut off water flow when the compressor is off.
6. **Variable Flow Controls.**
 - A. Variable Speed Drives. Individual pumps serving variable flow systems and having a motor horsepower exceeding 5 hp shall have controls and/or devices (such as variable speed control) that will result in pump

motor demand of no more than 30 percent of design wattage at 50 percent of design water flow. The pumps shall be controlled as a function of required differential pressure.

B. Pressure Sensor Location and Setpoint.

- i. For systems without direct digital control of individual coils reporting to the central control panel, differential pressure shall be measured at or near the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.
- ii. For systems with direct digital control of individual coils with central control panel, the static pressure set point shall be reset based on the valve requiring the most pressure, and the setpoint shall be no less than 80 percent open. The pressure sensor(s) may be mounted anywhere.

EXCEPTION 1 to Section 144140.4(kj)6: Heating hot water systems.

EXCEPTION 2 to Section 144140.4(kj)6: Condenser water systems serving only water-cooled chillers.

7. **Hydronic Heat Pump (WLHP) Controls.** Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of at least 20°F between initiation of heat rejection and heat addition by the central devices.

EXCEPTION to Section 144140.4(kj)7: Where a system loop temperature optimization controller is used to determine the most efficient operating temperature based on real-time conditions of demand and capacity, dead bands of less than 20°F shall be allowed.

(k) Air Distribution System Duct Leakage Sealing. All new duct systems shall be sealed to a leakage rate not to exceed 6 percent of the fan flow if the duct system:

1. Is connected to a constant volume, single zone, air conditioners, heat pumps or furnaces; and
2. Serving less than 5,000 square feet of floor area; and
3. Having more than 25 percent duct surface area located in one or more of the following spaces:

- A. Outdoors; or
- B. In a space directly under a roof where the U-factor of the roof is greater than the U-factor of the ceiling; or

EXCEPTION to Section 144140.4(k)3B: Where the roof meets the requirements of Section 140.3(a)1**CB**.

- C. In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces; or
- D. In an unconditioned crawlspace; or
- E. In other unconditioned spaces.

The leakage rate shall be confirmed through field verification and diagnostic testing, in accordance with procedures set forth in the Reference Nonresidential Appendix NA1 and NA2.

(m) Fan Control. Each cooling system listed in Table 140.4-D shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements:

~~**Variable air volume control for single zone systems.** Effective January 1, 2012 all unitary air conditioning equipment and air handling units with mechanical cooling capacity at ARI conditions greater than or equal to 110,000 Btu/hr that serve single zones shall be designed for variable supply air volume with their supply fans controlled by two speed motors, variable speed drives, or equipment that has been demonstrated to the Executive Director to use no more energy. The supply fan controls shall modulate down to a minimum of 2/3 of the full fan speed or lower at low cooling demand.~~

1. DX and chilled water cooling units that control the capacity of the mechanical cooling directly based on occupied space temperature shall have a minimum of 2 stages of fan control with no more than 66% speed when operating on stage 1. At 66% speed the fan system shall draw no more than 40% of the fan power at full fan speed.

2. All other units including DX cooling units and chilled water units that control the space temperature by modulating the airflow to the space shall have proportional fan control such that at 50% air flow the power draw is no more than 30% of the power at full fan speed.

3. Units that include an air side economizer to meet 140.4(e)1 shall have a minimum of 2 speeds of fan control during economizer operation.

EXCEPTION to Section 140.4(m): Modulating fan control is not required for chilled water and evaporative units with <1 HP fan motors if the units are not used to provide ventilation air and the indoor fan cycles with the load.

TABLE 140.4-D EFFECTIVE DATES FOR FAN CONTROL SYSTEMS

Cooling System Type	Fan Motor Size	Cooling Capacity	Effective Date
DX Cooling	any	≥110,000 Btu/hr	1/1/2012
		≥75,000 Btu/hr	1/1/2014
		≥65,000 Btu/hr	1/1/2016
Chilled Water and Evaporative	≥5 HP	any	1/1/2010
	≥1 HP	any	1/1/2014
	≥1/4 HP	any	1/1/2016

TABLE 141-A ECONOMIZER TRADE-OFF TABLE FOR ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS

Climate Zone	Size Category			
	≥760,000	≥240,000 and <760,000	≥135,000 and <240,000	≥65,000 and <135,000
1	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
4	11.9 (before 1/1/2010) 12.5 (as of 1/1/2010)	12.2 (before 1/1/2010) 12.9 (as of 1/1/2010)	12.4 (before 1/1/2010) 14.1 (as of 1/1/2010)	N/A
5	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A
8	11.9 (before 1/1/2010) 12.5 (as of 1/1/2010)	12.2 (before 1/1/2010) 12.9 (as of 1/1/2010)	12.4 (before 1/1/2010) 14.1 (as of 1/1/2010)	N/A
9	11.6 (before 1/1/2010) 12.2 (as of 1/1/2010)	11.9 (before 1/1/2010) 12.5 (as of 1/1/2010)	12.1 (before 1/1/2010) 13.7 (as of 1/1/2010)	N/A
10	11.4 (before 1/1/2010) 12.0 (as of 1/1/2010)	11.7 (before 1/1/2010) 12.3 (as of 1/1/2010)	11.9 (before 1/1/2010) 13.5 (as of 1/1/2010)	12.4 (before 1/1/2010) 13.5 (as of 1/1/2010)
11	11.5 (before 1/1/2010) 12.1 (as of 1/1/2010)	11.8 (before 1/1/2010) 12.4 (as of 1/1/2010)	12.0 (before 1/1/2010) 13.6 (as of 1/1/2010)	N/A
12	11.7 (before 1/1/2010) 12.3 (as of 1/1/2010)	12.0 (before 1/1/2010) 12.6 (as of 1/1/2010)	12.2 (before 1/1/2010) 13.8 (as of 1/1/2010)	N/A
13	11.2 (before 1/1/2010) 11.8 (as of 1/1/2010)	11.5 (before 1/1/2010) 12.1 (as of 1/1/2010)	11.7 (before 1/1/2010) 13.3 (as of 1/1/2010)	12.3 (before 1/1/2010) 13.4 (as of 1/1/2010)
14	11.7 (before 1/1/2010) 12.3 (as of 1/1/2010)	12.0 (before 1/1/2010) 12.6 (as of 1/1/2010)	12.2 (before 1/1/2010) 13.8 (as of 1/1/2010)	N/A
15	10.0 (before 1/1/2010) 10.6 (as of 1/1/2010)	10.4 (before 1/1/2010) 11.0 (as of 1/1/2010)	10.6 (before 1/1/2010) 12.0 (as of 1/1/2010)	11.3 (before 1/1/2010) 12.3 (as of 1/1/2010)
16	N/A	N/A	N/A	N/A

TABLE 144-B ECONOMIZER TRADE OFF TABLE FOR ELECTRICALLY OPERATED UNITARY HEAT PUMPS

Climate Zone	Size Category		
	≥240,000	≥135,000 and <240,000	≥65,000 and <135,000
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	11.7 (before 1/1/2010) 13.8 (as of 1/1/2010)	12.1 (before 1/1/2010) 13.8 (as of 1/1/2010)	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	12.3 (before 1/1/2010) 14.5 (as of 1/1/2010)	N/A	N/A
8	11.7 (before 1/1/2010) 13.8 (as of 1/1/2010)	12.0 (before 1/1/2010) 13.7 (as of 1/1/2010)	N/A
9	11.3 (before 1/1/2010) 13.3 (as of 1/1/2010)	11.7 (before 1/1/2010) 13.3 (as of 1/1/2010)	12.5 (before 1/1/2010) 13.6 (as of 1/1/2010)
10	11.1 (before 1/1/2010) 13.1 (as of 1/1/2010)	11.5 (before 1/1/2010) 13.1 (as of 1/1/2010)	12.3 (before 1/1/2010) 13.4 (as of 1/1/2010)
11	11.3 (before 1/1/2010) 13.3 (as of 1/1/2010)	11.6 (before 1/1/2010) 13.2 (as of 1/1/2010)	12.4 (before 1/1/2010) 13.5 (as of 1/1/2010)
12	11.5 (before 1/1/2010) 13.5 (as of 1/1/2010)	11.8 (before 1/1/2010) 13.4 (as of 1/1/2010)	N/A
13	10.9 (before 1/1/2010) 12.8 (as of 1/1/2010)	11.3 (before 1/1/2010) 12.9 (as of 1/1/2010)	12.1 (before 1/1/2010) 13.2 (as of 1/1/2010)
14	11.5 (before 1/1/2010) 13.5 (as of 1/1/2010)	11.8 (before 1/1/2010) 13.4 (as of 1/1/2010)	N/A
15	9.8 (before 1/1/2010) 11.5 (as of 1/1/2010)	10.1 (before 1/1/2010) 11.5 (as of 1/1/2010)	11.1 (before 1/1/2010) 12.1 (as of 1/1/2010)
16	N/A	N/A	N/A

TABLE 144 C AIR ECONOMIZER HIGH LIMIT SHUT-OFF CONTROL REQUIREMENTS

Device Type	Climate Zones	Required High Limit (Economizer Off When)	
		Equation	Description
Fixed-Dry Bulb	1, 2, 3, 5, 11, 13, 14, 15 & 16	$T_{OA} > 75^{\circ}\text{F}$	Outdoor air temperature exceeds 75°F
	4, 6, 7, 8, 9, 10 & 12	$T_{OA} > 70^{\circ}\text{F}$	Outdoor air temperature exceeds 70°F
Differential-Dry-Bulb	All	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature
Fixed-Enthalpy ^a	4, 6, 7, 8, 9, 10 & 12	$h_{OA} > 28 \text{ Btu/lb}^b$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air ^b
Electronic-Enthalpy	All	$(T_{OA}, RH_{OA}) > A$	Outdoor air temperature/RH exceeds the "A" set-point curve ^c
Differential-Enthalpy	All	$h_{OA} > h_{RA}$	Outdoor air enthalpy exceeds return air enthalpy

^a Fixed-Enthalpy Controls are prohibited in climate zones 1, 2, 3, 5, 11, 13, 14, 15 & 16.

^b 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 6000 foot elevation the fixed-enthalpy limit is approximately 30.7 Btu/lb.

^c Set point "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40% relative humidity and is nearly parallel to dry bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.

SECTION 140.5 – PRESCRIPTIVE REQUIREMENTS FOR SERVICE WATER HEATING SYSTEMS

- (a) **Nonresidential Occupancies.** A service water heating system installed in a nonresidential building complies with this section if it complies with the applicable requirements of Sections 110.1, 110.3 and 120.3.
- (b) **High-Rise Residential and Hotel/Motel Occupancies.** A service water heating system installed in high-rise residential and hotel/motel buildings comply with this section if it meets the requirements of Section 150.1(f)8.

140.6 NR Prescriptive Lighting

SECTION 140.6 – PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING

A building complies with this section if the actual lighting power density calculated under Subsection (a) is no greater than the allowed indoor lighting power calculated under Subsection (c), and lighting power trade-offs comply with Subsection (b) and general lighting in Secondary Sidelit Daylit Zones complies with the lighting controls requirements in Subsection (d).

- (a) **Calculation of Actual Indoor Lighting Power Density.** The actual indoor lighting power of ~~the~~ all proposed building areas is the total watts of all planned permanent and portable lighting systems; subject to the following specific requirements and adjustments under Subsections 1 through 4.

EXCEPTION to Section 140.6(a): Up to ~~0.2~~ 0.3 watts per square foot of portable lighting for office areas shall not be required to be included in the calculation of actual indoor lighting power density.

- ~~1. Multiple interlocked lighting systems serving a space. When multiple interlocked lighting systems serve an auditorium, convention center, conference room, multipurpose room, or theater, the watts of all systems except the system with the highest wattage may be excluded if the lighting systems are interlocked with a non-programmable double throw switch to prevent simultaneous operation.~~
1. **Two interlocked lighting systems:** When two interlocked lighting systems meet all of the following requirements, the watts of the lower wattage system may be excluded if:
 - A. An appropriately signed Installation Certificate specifically detailing compliance with Section 140.6(a)1 is submitted; and
 - B. The applicable requirements of Section 130.4 are met; and
 - C. The area, as defined in Section 100.1, is only the following types of function areas: Auditorium, convention center, conference room, multipurpose room, or theater; and
 - D. The two lighting systems are interlocked with a non-programmable double throw switch to prevent simultaneous operation.
- ~~2. Reduction of wattage through controls. The controlled watts of any luminaire may be reduced by the number of controlled watts times the applicable Power Adjustment Factor (PAF) from TABLE 146-C if:~~
 - ~~A. The control complies with the applicable requirements of Section 119; and~~
 - ~~B. At least 50 percent of the light output of the luminaire is within the applicable space listed in TABLE 146-C; and~~

~~Except as noted in TABLE 146-C, only one PAF is used for the luminaire; and~~

~~Multi-level occupant sensors used to qualify for the PAF in any space less than or equal to 250 square feet enclosed by floor to ceiling partitions, or any size classroom, corridor, conference or waiting room, shall meet the applicable requirements of Section 119. The multi-level occupancy sensor shall be installed to meet all the multi-level and uniformity requirements of Section 131(b) for the controlled lighting. The first stage shall activate between 30-70 percent of the lighting power in a room either through an automatic or manual action, and may be a switching or dimming system. After that event occurs any of the following actions shall be assigned to occur when manually called to do so by the occupant:~~

 - ~~i. Activating the alternate set of lights.~~
 - ~~ii. Activating 100 percent of the lighting power.~~
 - ~~iii. Deactivating all lights.~~
2. **Reduction of wattage through controls.** The installed watts of a luminaire may be reduced by the number of controlled watts times the applicable PAF from TABLE 140.6-A if the following conditions are met:
 - A. A completed and signed Installation Certificate in accordance with Section 130.4(b), specifically detailing compliance with the applicable requirements of Section 140.6(a)2, is submitted.
 - B. Functionally meet the applicable requirements of Section 110.9, and Sections 130.0 through 130.5.
 - C. PAFs shall be available only for general lighting in function areas specifically listed in TABLE 140.6-A, as defined in Section 100.1.
 - D. PAFs shall be available only for permanently installed general lighting systems controlled with permanently installed nonresidential-rated lighting controls. Portable lighting, portable lighting controls, and residential rated lighting controls shall not qualify for PAFs.

In offices, furniture mounted luminaires that comply with all of the following conditions shall qualify as permanently installed general lighting:

 - i. The furniture mounted lighting system shall be permanently installed at the time of building permit inspection.

- iv. Qualifying luminaires shall be controlled by fully functional occupant sensing controls as follows:
 - a. Infra-red sensors shall be equipped or fitted with lenses or shrouds to prevent them from reacting to movement outside of the controlled area.
 - b. Ultrasonic sensors shall be tuned to reduce their sensitivity to the point where they are not triggered by movements outside of the controlled area.
 - c. Other occupant sensing technologies shall be installed and adjusted as necessary so that they are not triggered by movements outside of the controlled area.
- iv. The PAFs shall be determined according to the size of the controlled areas, in accordance with Table 140.6-A, as follows:
 - a. At least one occupant sensing control per 125 square feet or less
 - b. At least one occupant sensing control per 126 to 250 square feet
 - c. At least one occupant sensing control per 251 to 500 square feet
- K. To qualify for the PAF for a dimming lighting control in accordance with Table 140.6-A, the following requirements shall be met:
 - i. Only hotel and motel function areas, dining areas, auditorium areas, and theater areas, as defined in Section 100.1, shall qualify for this PAF.
 - ii. The lighting shall be controlled with a fully functional dimmer control or multi-scene programmable control that can be manually operated by the user.
- L. To qualify for the Demand Responsive Control PAF in accordance with Table 140.6-A, the controlled lighting shall be capable of being automatically reduced by a demand responsive lighting control in accordance with the applicable requirements in Section 130.1(e)1A and B.
- M. To qualify for the combined dimming lighting control plus the partial-ON occupant sensing control in accordance with Table 140.6-A, the lighting controls shall comply with the applicable requirements in Section 140.6(a)2K, and lighting shall be controlled with a fully functional dimmer control or multi-scene programmable control that can be manually operated.

For automatic daylighting control PAFs, the luminaire(s) shall be controlled by the automatic daylighting control(s) complying with applicable requirements of Section 119 and installed according to Section 131(e)2D. The PAF's are calculated based on PAFs described below in Section 146(a) 2E (i through iii), and at least 50 percent of the controlled luminaires shall be located within the daylight area. Daylight controls shall not control lamps that are outside of the daylight area (skylit, primary sidelit, and/or secondary sidelit daylight areas). The daylight area associated with the daylighting control receiving the PAF shall be shown on the building plans. PAFs shall not be available for automatic daylighting controls required by Section 131(e)2B and C.

Power Adjustment Factor for controlling Primary Sidelit Daylight Areas:

The PAF for the primary sidelit daylight area shall be used only if the daylighting control is separately controlling lighting within the primary sidelit daylight area. If lighting in the primary sidelit area is controlled together with lighting in the secondary sidelit area, the PAF for the secondary sidelit area in accordance with Section 146(a) 2Eii shall be used. The PAF is a function of the effective aperture of the primary sidelit daylight area in accordance with Equation 146 A.

Equation 146 A — Effective Aperture OF the primary sidelit area

$$\text{Primary Sidelit Effective Aperture} = \frac{\sum \text{Window Area} \times VT}{\text{Primary Sidelit Daylight Area}}$$

Where:

Window Area = rough opening of windows adjacent to the sidelit area, ft²

~~Window VT = visible light transmittance of window, no units~~

~~Primary Sidelit Daylight Area = see Section 131(c)1 daylight area, primary sidelit~~

~~Power Adjustment Factor for controlling secondary sidelit areas:~~

~~To qualify for the secondary sidelit daylight area PAF, the lighting in the secondary sidelit daylight area, or the lighting in the combined primary and secondary sidelit areas shall be controlled separately from lighting outside of these sidelit areas. The PAF is a function of the effective aperture of the secondary sidelit area in accordance with Equation 146-B.~~

~~Equation 146-B Effective Aperture OF the Secondary sidelit area~~

~~$$\text{Secondary Sidelit Effective Aperture} = \frac{\sum \text{Window Area} \times \text{VT}}{\text{Secondary Sidelit Daylight Area} + \text{Primary Sidelit Daylight Area}}$$~~

~~Where:~~

~~Window Area = rough opening of windows adjacent to the sidelit area, ft²~~

~~Window VT = visible light transmittance of window, no units~~

~~Primary Sidelit Daylight Area = see Section 131(c)1B daylight area, primary sidelit~~

~~Secondary Sidelit Daylight Area = see Section 131(c)1C daylight area, secondary sidelit~~

~~Power Adjustment Factor for controlling skylit areas:~~

~~The PAF is a function of the lighting power density of the general lighting in the space and the effective aperture of the skylights shall be determined in accordance with Equation 146-C.~~

~~Equation 146-C Effective Aperture OF Skylights~~

~~$$\text{Skylit Effective Aperture} = \frac{0.85 \times \sum \text{Skylight Area} \times \text{VT} \times \text{Well Efficiency}}{\text{Skylit Daylight Area}}$$~~

~~Where:~~

~~Skylight Area = the area of each individual skylight~~

~~Skylit Daylight Area = see Section 131(c)1D daylight area, skylit~~

~~VT = visible light transmittance. The VT shall include all skylighting system accessories including diffusers, louvers and other attachments that impact the diffusion of skylight into the space. The visible light transmittance of movable accessories shall be rated in the full open position. When the visible light transmittance of glazing and accessories are rated separately, the overall glazing transmittance is the product of the visible light transmittances of the glazings and accessories.~~

~~Well Efficiency equals the ratio of the amount of visible light leaving a skylight well to the amount of visible light entering the skylight well. Well Efficiency shall be determined from Equation 146-F or Table 146-B for specular and tubular light wells and from Table 146-A for all other light wells, based on the weighted average reflectance of the walls of the well and the geometry of the light well, or other test method approved by the Commission.~~

~~The well efficiency for non-specular or non-tubular light wells is based on the average weighted reflectance of the walls of the light well and the well cavity ratio. The well cavity ratio (WCR) is determined by the geometry of the skylight well and shall be determined using either Equation 146-D or Equation 146-E.~~

~~Equation 146-d Well cavity ratio for rectangular wells~~

~~$$\text{WCR} = \left(\frac{5 \times \text{well height (well length + well width)}}{\text{well length} \times \text{well width}} \right); \text{ or}$$~~

~~Equation 146-e Well cavity ratio for non-rectangular shaped wells:~~

$$\text{WCR} = \left(\frac{2.5 \times \text{well height} \times \text{well perimeter}}{\text{well area}} \right)$$

Where the well perimeter and well area are measured at the bottom of the well.

~~EQUATION 146 F WELL EFFICIENCY FOR SPECULAR TUBULAR LIGHT WELLS:~~

$$\text{WE}_{\text{Tube}} = \rho \left(2.2 * \frac{L}{D} \right)$$

Where:

ρ = specular reflectance of interior light well wall

L/D = ratio of light well length to light well interior diameter

~~PAFs shall not be available for demand responsive lighting controls required by Section 131(g).~~

3. **Lighting wattage excluded.** The watts of the following lighting applications may be excluded from Section 140.6(c):
- A. In theme parks: Lighting for themes and special effects.
 - B. Studio lighting for film or photography provided that these lighting systems are separately switched from a general lighting system.
 - C. Lighting for dance floors, lighting for theatrical and other live performances, and theatrical lighting used for religious worship, provided that these lighting systems are additions to a general lighting system and are separately controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.
 - D. In civic facilities, transportation facilities, convention centers, and hotel function areas: Lighting for temporary exhibits, if the lighting is an addition to a general lighting system and is separately controlled from a panel accessible only to authorized operators.
 - E. Lighting installed by the manufacturer in ~~refrigerated cases~~, walk-in freezers, vending machines, food preparation equipment, and scientific and industrial equipment.
 - F. In medical and clinical buildings: Examination and surgical lights, low-ambient night-lights, and lighting integral to medical equipment, provided that these lighting systems are additions to and separately switched from a general lighting system.
 - G. Lighting for plant growth or maintenance, if it is controlled by a multi-level astronomical time-switch control that complies with the applicable provisions of Section ~~110.9~~.
 - H. Lighting equipment that is for sale.
 - I. Lighting demonstration equipment in lighting education facilities.
 - J. Lighting that is required for exit signs subject to the CBC. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.
 - K. Exitway or egress illumination that is normally off and that is subject to the CBC.
 - L. In hotel/motel buildings: Lighting in guestrooms (lighting in hotel/motel guestrooms shall comply with Section ~~130.0~~(b)).
 - M. In high-rise residential buildings: Lighting in dwelling units (Lighting in high-rise residential dwelling units shall comply with Section ~~130.0~~(b)).
 - N. Temporary lighting systems ~~as defined in Section 100.1~~.
 - O. Lighting in occupancy group U buildings less than 1000 square feet.
 - P. Lighting in unconditioned agricultural buildings less than 2500 square feet.

- Q. Lighting systems in qualified historic buildings, as defined in the State Historic Building Code (Title 24, Part 8), are exempt from the lighting power allowances, if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems in qualified buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other lighting systems in qualified historic buildings shall comply with the lighting power allowances.
- R. Lighting in nonresidential parking garages for seven or less vehicles: Lighting in nonresidential parking garages for seven or less vehicles shall comply with the applicable residential parking garage provisions of Section 150.0(k).
- S. Lighting for signs: Signs shall comply with Section 140.8.
- ~~T. Lighting in a videoconferencing studio: Up to 2.5 watts per square foot of lighting in a videoconferencing studio, provided the videoconferencing lighting is in addition to and separately switched from a general lighting system, all of the lighting is controlled by a multiscene programmable control system, and the videoconferencing studio has permanently installed videoconferencing cameras, audio equipment, and playback equipment.~~
- ~~U. Lighting for automatic teller machines that are located inside parking garages.~~
- ~~U. Lighting in refrigerated cases less than 3,000 square feet. (Refrigerated cases less than 3,000 square feet shall comply with the Title 20 Appliance Efficiency Regulations).~~
- ~~V. Lighting in elevators meeting the requirements of ASHRAE/IESNA Standard 90.1, 2010.~~
4. **Luminaire Power.** Luminaire power shall be determined in accordance with Section ~~130~~ 130.0(d) and (e)(c) ~~or by a method approved by the Commission.~~

(b) **Indoor Lighting Power Trade-offs.** Indoor lighting power trade-offs shall be determined as follows:

1. ~~Allowed lighting power for conditioned and unconditioned areas shall be separate allotments, which shall be met separately without trade-offs between the separate allotments.~~
2. ~~Allowed lighting power for indoor and outdoor areas shall be separate allotments, which shall be met separately without trade-offs between the separate allotments.~~
3. ~~Allowed lighting power determined according to the Complete Building Method may be traded only within a single building. Allowed lighting power shall not be traded between two or more buildings using the Complete Building Method. Conditioned and unconditioned spaces shall be separate allotments, which shall be met separately without trade-offs between the separate allotments.~~
24. Allowed lighting power for general illumination determined according to the Area Category Method may be traded only between ~~the~~ primary function areas using the Area Category Method. ~~Conditioned and unconditioned spaces shall be separate allotments, which shall be met separately without trade-offs between the separate allotments.~~
5. ~~EXCEPTION to Section 146(b)2:~~ Additional allowed lighting power ~~allowed determined~~ according to ~~TABLE 146-F Section 140.6(c)2G and TABLE 140.6-C footnotes shall not be traded be separate allotments without trade-offs between the separate allotments, and shall not be traded to general illumination.~~
36. Allowed lighting power for wall display, floor display, ~~and~~ ornamental/special effects, and very valuable display case lighting determined according to the Tailored Method shall be separate allotments without trade-offs between the separate allotments, and shall not be traded to general illumination.
7. Allowed lighting power for general illumination determined according to the Tailored Method may be traded only within ~~the~~ primary function areas using the Tailored Method.
48. Allowed lighting power shall not be traded between the Complete Building Method, Area Category Method or Tailored Method.

EXCEPTION to Section 140.6(b)48: Allowed lighting power for general illumination determined according to the Area Category Method may be traded ~~from primary function areas using the Area Category Method to primary function areas using~~ the Tailored Method for general illumination, wall display, floor display,

ornamental/special effects, or very valuable display case lighting, provided that the Area Category Method and the Tailored Method shall not use the same floor area for determining allowed lighting power.

.5. Trading off lighting power allowances between indoor and outdoor areas shall not be permitted.

(c) **Calculation of Allowed Indoor Lighting Power Density.** The allowed indoor lighting power density for each building type ~~of use~~, or each primary function area shall be calculated using ~~one and~~ only one of the methods in Subsection 1, 2 or 3 below as applicable.

1. **Complete Building Method.** Requirements for using the Complete Building Method include all of the following:

A. The Complete Building Method shall be used only for building types, as defined in Section 100.1, specifically listed in Table 140.6-B. Retail and wholesale stores, hotel/motel, and high-rise residential buildings shall not use this method.

B. Shall be used only on projects involving:

i. ~~E~~ntire buildings with one type of use occupancy; ~~or~~

EXCEPTION to Section 140.6(c)1Bi: If a parking garage plus another type of use specifically listed in Table 140.6-B are part of a single building, the parking garage portion of the building and other type of use portion of the building shall each separately use the Complete Building Method.

ii. ~~m~~Mixed occupancy buildings where one type of use ~~occupancy~~ makes up at least 90 percent of the entire building; ~~or~~

iii. ~~A~~ tenant space where one type of use makes up at least 90 percent of the entire tenant space.

C. This approach ~~s~~ shall only be used only when the applicant is applying for a lighting permit and submits plans and specifications for the entire building or the entire tenant space.

D. Under this approach, the allowed lighting power ~~density~~ is the lighting power density value in TABLE 140.6-B ~~TABLE 146-E~~ times the floor area of the entire building. ~~Retail and wholesale stores, hotel/motel, and high rise residential buildings shall not use this method.~~

EXCEPTION to Section 146(c) 1: When using the Complete Building Method, if a parking garage and another Type of Use are part of a single building, the parking garage portion of the building and the remaining portion of the building shall each separately use the Complete Building Method type of use categories from TABLE 146- TABLE 146-E.

2. **Area Category Method.** Requirements for using the Area Category Method include all of the following:

A. The Area Category Method shall be used for primary function areas, as defined in Section 100.1, ~~listed in~~ Table 140.6-C.

B. Under the Area Category Method, the total allowed lighting power for the building is the sum of all allowed lighting powers for all areas in the building. ~~Primary Function Areas in Table 140.6-C shall not apply to a complete building. Each primary function area shall be determined as a separate area.~~

C. For purposes of compliance with Section 140.6(c)2 ~~the Area Category Method~~, an "area" shall be defined as all contiguous ~~space~~ areas which accommodate or are associated with a single ~~one of the~~ primary function areas listed in TABLE 140.6-C ~~TABLE 146-F~~.

D. Where areas are bounded or separated by interior partitions, the floor ~~space~~ area occupied by those interior partitions ~~shall may~~ be included in any Primary Function A area.

E. If at the time of permitting a tenant is not identified for a multi-tenant ~~space~~ area, the ~~tenant~~ H leased ~~s~~ Space allowance from TABLE 140.6-C ~~TABLE 146-F~~ shall be used.

F. Under this approach, the allowed general lighting power is the lighting power density value in TABLE 140.6-C times the floor area of the primary function. The total allowed lighting power for the building is the sum of all allowed lighting powers for all areas in the building. ~~When the Area Category Method is used to calculate the allowed total lighting power for an entire building, main entry lobbies, corridors, restrooms, and support functions shall be treated as separate areas.~~

- G. Additional lighting power is available for specialized task work, ornamental, precision, accent, display, decorative, and white boards and chalk boards, in accordance with the footnotes in TABLE 140.6-C only under the following conditions:
- i. Only primary function areas having a footnote next to the allowed lighting power density in TABLE 140.6-C shall qualify for the added lighting power in accordance with the correlated footnote listed at the bottom of the table.
 - ii. The added lighting power shall be used only if the plans clearly identify all task areas and the lighting equipment designed to illuminate these tasks.
 - iii. Tasks that are performed less than two hours per day or poor quality tasks that can be improved are not eligible for these allowances.
 - iv. The additional lighting power shall not utilize the same types of luminaires as are used for general lighting.
 - v. This added lighting power shall not be used when using the Complete Building Method, or the Tailored Lighting Method of compliance.
 - vi. The smallest of the added lighting power listed in each footnote, or the actual design wattage may be added to the allowed lighting power.
 - vii. Up to 1.5 watts per square foot of additional lighting power shall be allowed in a videoconferencing studio, as defined in Section 100.1, provided the following conditions are met:
 - a. A completed and signed Installation Certificate in accordance with Section 130.4(b), specifically detailing compliance with the applicable requirements of Section 140.6(c)2G.
 - b. The Videoconferencing Studio is a room with permanently installed videoconferencing cameras, audio equipment, and playback equipment for both audio-based and video-based two-way communication between local and remote sites.
 - c. General lighting is switched in accordance with Table 130.1-A.
 - d. Wall wash lighting is separately switched from the general lighting system.
 - e. All of the lighting is controlled by a multiscene programmable control system (also known as a scene preset control system).
3. **Tailored Method.** Requirements for using the Tailored Method include all of the following:
- A. The Tailored Method shall be used only on projects with primary function areas that do not use the Area Category Method. The Tailored Method shall be used only for primary function areas listed in Table 140.6-D, as defined in Section 100.1, and for IES allowances listed in Section 140.6(c)3H.
 - B. General lighting power allowances shall be determined according to Section 140.6(c)3G or H. General lighting shall not qualify for a mounting height multiplier.
 - C. For purposes of compliance with Section 140.6(c)3, an "area" shall be defined as all contiguous areas which accommodate or are associated with a single primary function area listed in TABLE 140.6-D.
 - D. Where areas are bounded or separated by interior partitions, the floor area occupied by those interior partitions may be included in the Primary Function Area.
 - E. Additional allowed lighting power for wall display, floor display and task lighting, ornamental/special effects, and very valuable display cases shall be determined according to Section 140.6(c)3I through L.
 - F. The general lighting system shall not use narrow beam direction lamps, wall-washer, valance, direct cove, or perimeter linear slot types of lighting systems. Under the Tailored Method, the allowed indoor lighting power shall be calculated according to primary function type as permitted in column 1 of TABLE 146-G.
 - A. TABLE 146 For all spaces, determine the general lighting allowance according to Section 146(c)3A:
 - i. If a specific IESNA Illuminance Category is listed in Column 2 of TABLE 146 TABLE 146-G, then such illuminance Category shall be used. Otherwise, determine the illuminance category for each lighting primary

function type according to categories specified in the IESNA Lighting Handbook (IESNA HB), using the "Design Guide" for illuminance. Tasks that are performed less than 2 hours a day or poor quality tasks that can be improved shall not be employed to justify use of Illuminance Categories E, F, or G.

G. Determine allowed general lighting power for primary function areas listed in Table 140.6-D as follows:

- i. Use the IES Illuminance values (Lux) listed in Column 2 to determine the Allowed General Lighting Power for the area.
- ii. Determine the area of each primary function.
- iii. Determine the room cavity ratio (RCR) for each primary function area. The RCR shall be calculated using either EQUATION 146-G or EQUATION 146-H according to the applicable equation in Table 140.6-F.
- iii. Find the allowed lighting power density in Table 140.6-G using information determined in accordance with items i and ii.
- iv. Determine the area of each primary function in accordance with Section 140.6(c)3C and D.

EQUATION 146-G ROOM CAVITY RATIO FOR RECTANGULAR ROOMS

$$RCR = \frac{5 \times H \times (L + W)}{L \times W}$$

EQUATION 146-H ROOM CAVITY RATIO FOR IRREGULAR SHAPED ROOMS

$$RCR = \frac{2.5 \times H \times P}{A}$$

WHERE:

- L = Length of room.
W = Width of room.
H = Vertical distance from the work plane to the centerline of the lighting fixture.
P = Perimeter of room.
A = Area of room.

- iv. Multiply the area of each primary function by the allowed lighting power density in accordance with item iii by the area of each primary function in accordance with item iv for the illuminance category and RCR for each primary function area according to TABLE 146-I. The product or the actual installed lighting power for the primary function, whichever is less, is the Allowed General Lighting Power for the space area.

H. Determine allowed general lighting power only for primary function areas listed in this subsection as follows:

- i. Section 140.6(c)3H shall be used to determine general lighting power only for primary function areas listed below:
 - a. Exercise Center, Gymnasium
 - b. Medical and Clinical Care
 - c. Police or Fire Stations
 - d. Public rest areas along state and federal roadways

- e. Other primary function areas that are not listed in TABLE 140.6-C or TABLE 140.6-D
 - ii. When determining general lighting power allowances using Section 140.6(c)3H, additional light power for wall display, floor display and task, ornamental/special effects, and very valuable display case lighting shall not be allowed.
 - iii. Determine the illuminance values (Lux) for each lighting primary function type according to categories specified in the Tenth Edition IES Lighting Handbook (IES HB), using the Recommended Horizontal Maintained Illuminance Targets for Observers 25-65 years old for illuminance.
 - iv. Determine the room cavity ratio (RCR) for each primary function area. The RCR shall be calculated according to the applicable equation in Table 140.6-F.
 - v. Find the allowed lighting power density in Table 140.6-G using information determined in accordance with items iii and iv.
 - vi. Determine the area of each primary function in accordance with Section 140.6(c)3(C and D).
 - vii. Multiply the area of each primary function in accordance with item vi, by the allowed lighting power density in accordance with item v. The product is the Allowed General Lighting Power for the area.
- BI.** Determine additional allowed power for wall display and decorative lighting according to Sections 146(c)3B, as follows:
- i. Additional wall display lighting power shall not be available when using Section 140.6(c)3H for determining general lighting power allowances.
 - ii. Displays that are installed against a wall shall not qualify for the floor display lighting power allowances. Floor displays shall not qualify for the wall display allowances.
 - iii. Qualifying wall lighting systems shall:
 - a. Be mounted within 10 feet of the wall having the wall display. Portions of lighting track greater than 10 feet from the wall shall not be used for the wall display allowance.
 - b. Be a lighting system type appropriate for wall lighting including lighting track and lamp holders adjacent to the wall, wall-washer luminaires, luminaires behind a wall valance or wall cove, or accent light including adjustable or fixed luminaires with PAR, R, MR, AR, or other directional lamp types.
 - iv. Separate w Wall display lighting power shall be used only for a Primary Function Areas listed in TABLE 140.6-D according to the corresponding value in column 3.

The allowed wall display lighting power is the smaller of:

- a. The product of the room wall lengths and the listed allowed power density watts per linear foot (W/lf) in column 3 of TABLE 146-G if applicable, or b. The actual power of wall lighting systems.
- v. This allowance shall be used only on walls having wall displays. The length of display walls shall include the length of the perimeter walls, including closable openings and permanent full height interior partitions. Permanent full height partitions are those which extend from the floor to within 2 feet of the ceiling or are taller than 10 feet, and are permanently anchored to the floor. Commercial and industrial storage stacks are not permanent full height partitions.

The length of display walls shall include the length of the perimeter walls, including closable openings and permanent full height interior partitions. Permanent full height partitions are those which extend from the floor to within 2 feet of the ceiling or are taller than 10 feet, and are permanently anchored to the floor. Commercial and industrial storage stacks are not permanent full height partitions. For lighting mounting height of 11 feet 6 inches above the finished floor or higher, this amount may be increased by multiplying the product by the appropriate factor from TABLE 146-H. Qualifying wall lighting systems shall be mounted within 10 feet of the wall and shall be of a lighting system type appropriate for wall

lighting including a lighting track, wallwasher, valance, cove, or accent light including adjustable or fixed luminaires with PAR, R, MR, AR, or other projector lamp types.

- vi. The wall display mounting height multiplier is the factor from TABLE 140.6-E. Mounting height is the distance from the finished floor to the bottom of the luminaire. Wall display lighting with varying mounting heights shall be separately determined in item vii.
- vii. The allowed wall display lighting power shall be the smaller of:
 - a. The product of allowed wall display power in accordance with item iv, times wall display lengths in accordance with item v, times the mounting height multiplier in accordance with item vi; or
 - b. The actual power used for the wall display lighting systems.
- J. Determine additional allowed power for floor display lighting and/or task lighting as follows:
 - i. This additional floor display lighting and/or task power shall not be available when using Section 140.6(c)3H for determining general lighting power allowances.
 - ii. Displays that are installed against a wall shall not qualify for the floor display lighting power allowances.
 - iii. Lighting internal to display cases shall be counted as floor display lighting in accordance with Section 140.6(c)3J; or very valuable display case lighting in accordance with Section 140.6(c)3Liii and iv.
 - iv. This additional floor display and/or task power may be used by qualifying floor display lighting systems, qualifying task lighting systems, or a combination of both.
 - v. Qualifying floor display lighting systems shall:
 - a. Be mounted no closer than 2 feet to a wall.
 - b. Consist of only directional lighting types, such as PAR, R, MR, AR, or employing optics providing directional display light from non-directional lamps.
 - c. If track lighting is used, be only track heads that are classified as direction lighting types.
 - vi. Qualifying task lighting systems shall:
 - a. Be located immediately adjacent to and capable of illuminating the task for which it is installed.
 - b. Be of a type different from the general lighting system.
 - c. Be separately switched from the general lighting system.
 - vii. If there are illuminated floor displays, ~~Separate floor display lighting power is allowed shall be used only if allowed by column 4 of TABLE 146-G~~ TABLE 140.6-D.
 - viii. This allowance shall be used only on floors having floor displays or tasks having illuminance recommendations in the Tenth Edition of the IES Lighting Handbook, that are higher than the general lighting level in column 2. The floor display or tasks area shall be determined in accordance with Section 140.6(c)3C and D, minus any floor area designed to not have floor displays or tasks, such as floor areas designated as a path of egress.
 - ix. For floor display lighting where the bottom of the luminaire is 12 feet or higher above the finished floor, this amount may be increased by multiplying the floor display lighting power allowance by the appropriate factor from TABLE 140.6-E.
 - x. The allowed floor display lighting power shall be the smaller of:
 - a. The product of allowed floor display power determined in accordance with Section 140.6(c)3Jv times floor area determined in accordance with Section 140.6(c)3Jvii times the height multiplier if appropriate in accordance with Section 140.6(c)3Jix plus the product of allowed task lighting power determined in accordance with Section 140.6(c)3Jvi times task area determined in accordance with Section 140.6(c)3Jvi; or

- ~~b. The actual power used for the floor display lighting systems. The allowed floor display lighting power is the smaller of:~~
- ~~a. The product of the area of the primary function and the allowed floor display lighting power density listed in column 4 of , if applicable, or~~
- ~~b. The actual power of floor display lighting systems. For display lighting mounting of 11 feet 6 inches above finished floor or higher, this amount may be increased by multiplying the product by the appropriate factor from TABLE 146 . TABLE 146 H. Qualifying floor display lighting systems shall be mounted no closer than 2 feet to a wall and shall be a lighting system type such as track lighting, adjustable or fixed luminaires with PAR, R, MR, AR, or other projector lamp types or employing optics providing directional display light from non-directional lamps. Except for lighting that is external to display cases as defined below, lighting mounted inside of display cases shall also be considered floor display lighting.~~

K. Determine additional allowed power for ornamental/special effects lighting as follows:

- i. This additional lighting power for ornamental/special effects shall not be available when using Section 140.6(c)3H for determining general lighting power allowances.
- ii. Qualifying ornamental luminaires include chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights, and light color panels, when used in a decorative manner that does not serve as display lighting or general lighting.
- ~~iii. If there is qualifying ornamental/special effects lighting~~ Separate, ornamental/special effects lighting power is permitted shall be used only if allowed by column 5 of
- ~~TABLE 146 G .TABLE 140.6-D.~~
- iv. This allowance shall be used only on in areas having ornamental/special effects lighting. The floor area shall be determine in accordance with Section 140.6(c)3C and D, not including floor areas not having ornamental/special effects lighting.
- v. ~~If so, t~~The allowed ornamental/special effects lighting power is the smaller of:
- a. The product of the allowed ornamental/special effects lighting power determined in accordance with Section 140.6(c)3Kiv, times floor area determined in accordance with Section 140.6(c)3Kv; The product of the area of the primary function and the allowed ornamental/special effects lighting power density specified in column 5 of , if applicable, or
- b. The actual power of allowed ornamental/special effects lighting luminaires. Qualifying ornamental luminaires include chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights, and light color panels when used in a decorative manner that does not serve as display lighting. Ornamental/special effects lighting shall not be the only light source in the space.

L. Determine additional allowed power for very valuable display case lighting as follows:

- i. This additional lighting power for very valuable display case shall not be available when using Section 140.6(c)3H for determining general lighting power allowances.
- ii. This allowance shall be used only in retail merchandise sales, museum, and religious worship function areas.
- iii. To qualify for this allowance cases shall contain jewelry, coins, fine china or crystal, precious stones, silver, small art objects and artifacts, and/or valuable collections the display of which involves customer inspection of very fine detail from outside of a locked case.
- iv. Qualifying lighting includes internal display case lighting or external lighting employing highly directional luminaires specifically designed to illuminate the case or inspection area without spill light, and shall not be fluorescent lighting unless installed inside of a display case.
- v. If there is qualifying very valuable display case lighting

~~iv. In retail merchandise sales, museum, and religious worship, in accordance with Section 140.6(c)3Liii, the smallest of the following separate lighting power for display cases presenting very valuable display items is permitted:~~

- ~~a. The product of the area of the primary function and $1.00.8$ watt per square foot; or~~
- ~~b. The product of the area of the display case and 1.612 watts per square foot; or~~
- ~~c. The actual power of lighting for very valuable displays.~~

~~Qualifying lighting includes internal display case lighting or external lighting employing highly directional luminaires specifically designed to illuminate the case or inspection area without spill light. To qualify for this allowance, cases shall contain jewelry, coins, fine china or crystal, precious stones, silver, small art objects and artifacts, and/or valuable collections the display of which involves customer inspection of very fine detail from outside of a locked case.~~

~~v. Only the general portion of the lighting power determined in Section 146(c)3A above shall be used for tradeoffs among the various occupancy or task types of the permitted space. The allowed wall display lighting power, the allowed floor display lighting power, the allowed ornamental/special effect lighting power, and the allowed lighting power for very valuable displays are “use it or lose it” power allowances that shall not be traded off. EQUATION 146-GEQUATION 146-HTABLE 146-TABLE 146-TABLE 146-E~~

(d) Automatic Daylighting Controls in Secondary Daylit Zones. Luminaires providing general lighting that are in, or partially in, the Secondary Sidelit Daylit Zones, and not included in the Primary Sidelit Daylit Zones shall be controlled independently by an automatic daylighting control that meets the applicable requirements of Section 110.9, is installed in accordance with Section 130.1(d)2C, and shall meet the following requirements as applicable:

1. SECONDARY SIDELIT DAYLIT ZONE is defined in Section 130.1(d).
2. All Secondary Sidelit Daylit Zones shall be shown on plan.
3. Luminaires in the Secondary Sidelit Daylit Zones shall be controlled separately from those in the Primary Sidelit Daylit Zones and Skylit Daylit Zones.
4. Luminaires that fall in a Skylit and Secondary Sidelit Daylit Zone shall be controlled as part of the Skylit Daylit Zone.

EXCEPTION 1 to Section 140.6(d): Total wattage of general lighting that is in or partially in a Secondary Sidelit Daylit Zone(s) is less than 120 Watts

EXCEPTION 2 to Section 140.6(d): Parking garages complying with Section 130.1(d)3.

TABLE 146-A WELL EFFICIENCY FOR NON-SPECULAR OR NON-TUBULAR LIGHT WELLS

WCR	light well wall reflectance					
	$\rho=99\%$	$\rho=90\%$	$\rho=80\%$	$\rho=70\%$	$\rho=60\%$	$\rho=40\%$
0	1.00	1.00	1.00	1.00	1.00	1.00
1	1.00	0.98	0.96	0.94	0.92	0.89
2	0.99	0.95	0.91	0.88	0.84	0.78
4	0.99	0.90	0.82	0.76	0.70	0.61
6	0.98	0.85	0.74	0.65	0.58	0.48
8	0.97	0.79	0.66	0.56	0.49	0.38
10	0.96	0.74	0.59	0.49	0.41	0.31
12	0.95	0.70	0.53	0.43	0.35	0.26
14	0.95	0.66	0.48	0.38	0.31	0.22
16	0.94	0.62	0.44	0.34	0.27	0.18
18	0.93	0.59	0.41	0.31	0.24	0.16
20	0.92	0.56	0.38	0.28	0.21	0.14

TABLE 146-B WELL EFFICIENCY FOR SPECULAR TUBULAR LIGHT WELLS

L/D	Light Well Reflectance (ρ)						
	$\rho=99\%$	$\rho=97\%$	$\rho=95\%$	$\rho=92\%$	$\rho=90\%$	$\rho=85\%$	$\rho=80\%$
0.5	0.99	0.97	0.95	0.91	0.89	0.84	0.78
1.0	0.98	0.94	0.89	0.83	0.79	0.70	0.61
1.5	0.97	0.90	0.84	0.76	0.71	0.58	0.48
2.0	0.96	0.87	0.80	0.69	0.63	0.49	0.37
2.5	0.95	0.85	0.75	0.63	0.56	0.41	0.29
3.0	0.94	0.82	0.71	0.58	0.50	0.34	0.23
3.5	0.93	0.79	0.67	0.53	0.44	0.29	0.18
4.0	0.92	0.76	0.64	0.48	0.39	0.24	0.14
4.5	0.91	0.74	0.60	0.44	0.35	0.20	0.11
5.0	0.90	0.71	0.57	0.40	0.31	0.17	0.09
5.5	0.88	0.68	0.52	0.35	0.26	0.13	0.06
6.0	0.87	0.65	0.48	0.30	0.22	0.10	0.04

TABLE 146-C LIGHTING POWER ADJUSTMENT FACTORS

TYPE OF CONTROL		TYPE OF SPACE				FACTOR
Multi-level occupant sensor (see Note 2) combined with multi-level circuitry and switching in accordance with Section 146(a)2D		Any space \leq 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, corridor, conference or waiting room.				0.20
Multi-level occupant sensor (see Note 2) that reduces lighting power at least 50% when no persons are present. May be a switching or dimming (see Note 3) system.		Hallways of hotels/motels, multi-family, dormitory, and senior housing				0.25
		Commercial and Industrial Storage stack areas (max. 2 aisles per sensor)				0.15
		Library Stacks (maximum 2 aisles per sensor)				0.15
Dimming system	Manual	Hotels/motels, restaurants, auditoriums, theaters				0.10
	Multiscene programmable	Hotels/motels, restaurants, auditoriums, theaters				0.20
Demand responsive lighting control that reduces lighting power consumption in response to a demand response signal. (See Note 1)		All building types				0.05
Manual dimming of dimmable electronic ballasts. (see Note 3)		All building types				0.10
Demand responsive lighting control that reduces lighting power consumption in response to a demand response signal when used in combination with manual dimming of dimmable electronic ballasts (see Note 1 and 3).		All building types				0.15
Combined Controls	Multi-level occupant sensor (see Note 2) combined with multi-level circuitry and switching in accordance with Section 146(a)2D combined with automatic multi-level daylighting controls	Any space \leq 250 square feet within a daylit area and enclosed by floor to ceiling partitions, any size classroom, corridor, conference or waiting room. The PAF may be added to the daylighting control credit				0.10
	Manual dimming of dimmable electronic ballasts (see Note 3) when used in combination with a multi-level occupant sensor (see Note 2) combined with multi-level circuitry and switching in accordance with Section 146(a)2D.	Any space \leq 250 square feet enclosed by floor to ceiling partitions; any size classroom, corridor, conference or waiting room				0.25
Automatic multi-level daylighting controls (See Note 4)	Total primary sidelit daylight areas less than 2,500 ft ² in an enclosed space and all secondary sidelit areas. (see Note 4)	Effective Aperture				
		General Lighting Power Density (W/ft ²)	$>10\%$ and $\leq 20\%$	$>20\%$ and $\leq 35\%$	$>35\%$ and $\leq 65\%$	$>65\%$
		All	0.12	0.20	0.25	0.30
	Total skylit daylight areas in an enclosed space less than 2,500 square feet, and where glazing material or diffuser has ASTM D1003 haze measurement greater than 90%	Effective Aperture				
		General Lighting Power Density (W/ft ²)	$0.6\% \leq EA < 1\%$	$1\% \leq EA < 1.4\%$	$1.4\% \leq EA < 1.8\%$	$1.8\% \leq EA$
		LPD < 0.7	0.24	0.30	0.32	0.34
		$0.7 \leq LPD < 1.0$	0.18	0.26	0.30	0.32
		$1.0 \leq LPD < 1.4$	0.12	0.22	0.26	0.28
		$1.4 \leq LPD$	0.08	0.20	0.24	0.28
	NOTES FOR TABLE 146-C:					
1. PAFs shall not be available for lighting controls required by Title 24, Part 6.						
2. To qualify for the PAF the multi-level occupant sensor shall comply with the applicable requirements of Section 119.						
3. To qualify for the PAF all dimming ballasts for T5 and T8 linear fluorescent lamps shall be electronic and shall be certified to the Commission with a minimum RSE in accordance with Table 146-D.						
4. If the primary sidelit daylight area and the secondary sidelit daylight area are controlled together, the PAF is determined based on the secondary sidelit effective aperture for both the primary sidelit daylight area and the secondary sidelit daylight area.						

TABLE 146-D RELATIVE SYSTEM EFFICIENCY (RSE) FOR DIMMABLE ELECTRONIC BALLASTS USED TO QUALIFY FOR POWER ADJUSTMENT FACTOR

RSE is required only for dimmable electronic ballasts for T5 and T8 fluorescent lighting systems used to qualify for a PAF according to Note 2 for TABLE 146-C.

Lamp Category	1 or 2 Lamps			1 x 28W Lamp	2 x 28W Lamps	1 x 54W HO Lamps	2 x 54W HO Lamps
T5	0.85			3.03	1.51	1.57	0.78
Required Relative System Efficiency (RSE)		Corresponding Ballast Efficacy Factor (BEF) †					
Lamp Category	1 Lamp	2 or 3 Lamps	4 Lamps	1 x 32W Lamps	2 x 32W Lamps	3 x 32W Lamps	4 x 32W Lamps
T8	0.86	0.90	0.98	2.69	1.4	0.93	0.76
† To calculate corresponding BEFs for lamp wattages and number of lamps not shown, use the following formula:							
$BEF = \left(\frac{RSE \times 100}{\# \text{ lamps} \times \text{lamp watts}} \right)$							
$RSE = \left(\frac{\text{Ballast Factor}}{\text{Ballast Input Power} / \text{Total Rated Lamp Power}} \right)$							
NOTE: Total Rated Lamp Power = number of Lamps per Ballast x Rated Lamp Power.							

TABLE 140.6-A LIGHTING POWER ADJUSTMENT FACTORS

TYPE OF CONTROL	TYPE OF AREA	FACTOR	
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			
Partial-ON Occupant Sensing Control	Any area ≤ 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, conference or waiting room.	0.20	
Occupant Sensing Controls in Large Open Plan Offices	In open plan offices greater than 250 square feet: One sensor controlling an area that is:	No larger than 125 square feet	0.40
		From 126 to 250 square feet	0.30
		From 251 to 500 square feet	0.20
Dimming System	Manual Dimming	Hotels/motels, restaurants, auditoriums, theaters	0.10
	Multiscene Programmable		0.20
Demand Responsive Control	All building types less than 10,000 square feet	0.05	
Combined Manual Dimming plus Partial-ON Occupant Sensing Control	Any area ≤ 250 square feet enclosed by floor-to-ceiling partitions; any size classroom, conference or waiting room	0.25	

TABLE 146-E COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES (WATTS/FT²)

TYPE OF USE	ALLOWED LIGHTING POWER
Auditoriums	1.5
Classroom Building	1.1
Commercial and industrial storage buildings	0.6
Convention centers	1.2
Financial institutions	1.1
General commercial and industrial work buildings	
— High bay	1.0
— Low bay	1.0
Grocery Stores	1.5
Library	1.3
Medical buildings and clinics	1.1
Office buildings	0.85
Parking Garages	0.3
Religious facilities	1.6
Restaurants	1.2
Schools	1.0
Theaters	1.3
All others	0.6

TABLE 140.6-B COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES (WATTS/FT²)

TYPE OF BUILDING	ALLOWED LIGHTING POWER
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 146 F AREA CATEGORY METHOD – LIGHTING POWER DENSITY VALUES (WATTS/FT²)

PRIMARY FUNCTION		ALLOWED LIGHTING POWER (W/ft ²)	PRIMARY FUNCTION	ALLOWED LIGHTING POWER (W/ft ²)	
Auditorium		1.5 ⁺	Laboratory, Scientific	1.4 ⁺	
Auto Repair		0.9 ⁻²	Laundry	0.9	
Beauty Salon		1.7	Library	Reading areas	1.2
Civic Meeting Place		1.3 ⁺		Stacks	1.5
Classrooms, lecture, training, vocational room		1.2	Lobbies	Hotel lobby	1.1 ⁺
Commercial and industrial storage (conditioned and unconditioned)		0.6		Main entry lobby	1.5 ⁺
Commercial and industrial storage (refrigerated)		0.7	Locker/dressing room	0.8	
Convention, conference, multipurpose and meeting centers		1.4 ⁺	Lounge/recreation	1.1	
Corridors, restrooms, stairs, and support areas		0.6	Malls and atria	1.2 ⁺	
Dining		1.1 ⁺	Medical and clinical care	1.2	
Electrical, mechanical, telephone rooms		0.7 ⁻²	Offices	>250 square feet	0.9
Exercise center, gymnasium		1.0		≤250 square feet	1.1
Exhibit, museum		2.0	Parking Garage	Parking Area	0.2
Financial transactions		1.2 ⁺		Ramps and Entries	0.6
General commercial and industrial work	Low-bay	0.9 ⁻²	Religious Worship		1.5 ⁺
	High-bay	1.0 ⁻²	Retail merchandise sales, wholesale showrooms		1.6
	Precision	1.2 ⁻²	Tenant lease space		1.0
Grocery Sales		1.6	Theaters	Motion picture	0.9 ⁺
Hotel function area		1.5 ⁺		Performance	1.4 ⁺
Housing, Public, and Commons Multi-family Areas, Dormitory		1.0	Transportation Function		1.2
Senior Housing		1.5	Waiting area	1.1 ⁺	
Kitchen, food preparation		1.6	All other	0.6	

FOOTNOTES:

1. The smallest of the following values may be added to the allowed lighting power for ornamental chandeliers and sconces that are in addition to and switched or dimmed on circuits different from the circuits for general lighting:

- _____ a. One watt per square foot times the area of the task space that the chandelier or sconce is in; or
- _____ b. The actual design wattage of the chandelier or sconce.

2. The smallest of the following values may be added to the allowed lighting power for specialized task work:

- _____ a. 0.5 watt per square foot times the area of the task space required for an art, craft assembly or manufacturing operation; or
- _____ b. The actual design wattage of the luminaire(s) providing illuminance to the specialized task area.

For spaces employing this allowance, the plans shall clearly identify all task spaces using these tasks and the lighting equipment designed to illuminate these tasks. Tasks that are performed less than two hours per day or poor quality tasks that can be improved are not eligible for this specialized task work allowance.

3. The smallest of the following values may be added to the allowed power for precision commercial and industrial work:

- _____ a. One watt per square foot times the area of the task space required for the precision work; or
- _____ b. The actual design wattage of the luminaire(s) providing the illuminance to the precision task area.

For spaces employing this allowance, the plans shall clearly identify all task spaces using these tasks and the lighting equipment designed to illuminate these tasks. Tasks that are performed less than two hours per day or poor quality tasks that can be improved are not eligible for this precision task work allowance.

4. The smallest of the following values may be added to the allowed lighting power for specialized task work:
 _____ a. 0.2 watt per square foot times the area of the task space required for a lab in a school; or
 _____ b. The actual design wattage of the luminaire(s) providing illuminance to the specialized task area.

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

PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER (W/ft²)	PRIMARY FUNCTION		ALLOWED LIGHTING POWER (W/ft²)
Auditorium Area		1.5 ³	Library Area	Reading areas	1.2 ³
Auto Repair Area		0.9 ²		Stack areas	1.5 ³
Beauty Salon Area		1.7	Lobby Area	Hotel lobby	1.1 ¹
Civic Meeting Place Area		1.3 ³		Main entry lobby	1.5 ¹
Classroom, Lecture, Training, Vocational Areas		1.2 ⁵	Locker/Dressing Room		0.8
Commercial and Industrial Storage Areas (conditioned and unconditioned)		0.6	Lounge/Recreation Area		1.1
Commercial and Industrial Storage Areas (refrigerated)		0.7	Malls and Atria		1.2 ³
Convention, Conference, Multipurpose and Meeting Center Areas		1.4 ³	Medical and Clinical Care Area		1.2
Corridor, Restroom, Stair, and Support Areas		0.6	Office Area	> 250 square feet	0.75
Dining Area		1.1 ³		≤ 250 square feet	1.0
Electrical, Mechanical, Telephone Rooms		0.7 ²	Parking Garage Area	Parking Area	0.14
Exercise Center, Gymnasium Areas		1.0		Dedicated Ramps	0.3
Exhibit, Museum Areas		2.0		Daylight Adaptation Zones ⁹	0.6
Financial Transaction Area		1.2 ³	Religious Worship Area		1.5 ³
General Commercial and Industrial Work Areas	Low bay	0.9 ²	Retail Merchandise Sales, Wholesale Showroom Areas		1.2 ^{6 and 7}
	High bay	1.0 ²	Tenant Lease Space		0.75
	Precision	1.2 ⁴	Theater Area	Motion picture	0.9 ³
Grocery Sales Area	1.2 ^{6 and 7}	Performance		1.4 ³	
Hotel Function Area		1.5 ³	Transportation Function Area		1.2
Kitchen, Food Preparation Areas		1.6	Videoconferencing Studio		1.2 ⁸
Laboratory Area, Scientific		1.4 ¹	Waiting Area		1.1 ³
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 ² of task area unless otherwise noted)
1	Specialized task work	0.2 W/ft ²
2	Specialized task work	0.5 W/ft ²
3	Ornamental lighting as defined in Section 100.1 and in accordance with Section 140.6(c)2.	0.5 W/ft ²
4	Precision commercial and industrial work	1.0 W/ft ²
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 ²
7	Decorative lighting - primary function shall be decorative and shall be in addition to general illumination.	0.2 W/ft ²
8	Additional Videoconferencing Studio lighting complying with all of the requirements in Section 140.6(c)2Gvii.	1.5 W/ft ²
9	Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage	

TABLE 146-G TAILORED METHOD SPECIAL LIGHTING POWER ALLOWANCES

1	2	3	4	5
Primary Function	Illumination Category	Wall Display Power (W/ft)	Allowed Floor Display Power (W/ft ²)	Allowed Ornamental/Special Effect Lighting
Auditorium	D	2.25	0.3	0.5
Civic Meeting Place	D	3-15	0.2	0.5
Commercial and industrial storage				
— Inactive	B			
— Active: bulky items; large labels	C			
— Active: small items; small labels	D			
Convention, conference, multipurpose, and meeting centers	D	2.5	0.4	0.5
Correction Facility cells and day rooms	D	0	0	0
Dining	B	1.5	0.6	0.6
Dressing room	D	0	0	0
Education facilities				
— Classrooms, lecture, training, vocational room	D	5.5	0	0
— Science Labs	E	5.5	0	0
Exercise center, gymnasium	IESNA-HB	0	0	0
Exhibit, museum	C	20.0	1.4	0.7
Financial Transactions	D	3-15	0.2	0.6
Food Service Facilities				
— Butcher Shop, Food Display, Galley, Kitchen, Scullery	E	0	0	0
— All other	C	0	0	0
Grocery store	D	9.9	1.1	0
Housing, Public, and Commons Areas				
— Multi-family	D	0	0	0.9
— Dormitory, Senior Housing	D	0	0	0.9
Hotel function area	D	2.25	0.2	0.5
Laundry	D	0	0	0
Library (Reading areas, Stacks) †	D	0	0	0.6
Lobbies:				
— Hotel lobby	C	3-15	0.2	0.60
— Main entry lobby	C		0.2	
Locker †	C	0	0	0
Lounge/recreation	C	7	0	0.7
Malls and atria	D	3.5	0.5	0.6
Medical and clinical care	IESNA-HB	0	0	0
Office		0	0	0
— Open office, Intensive VDT use	D			
— Open office, Intermittent VDT use	E			
— Private office	E			
Police or fire stations	IESNA-HB	0	0	0
Religious worship	D	1.5	0.5	0.5
Retail merchandise sales, wholesale showrooms	D	17.0	1.2	0.7

Public rest areas along state and federal roadways	IESNA HB	0	0	0
Stairways and corridors, toilets and washrooms	B	0	0	0
Tenant lease space	C	0	0	0
Theaters:				
— Motion picture	C	3	0	0.6
— Performance	D	6	0	0.6
Transportation Function	D	3-15	0.3	0.6
Waiting area	C	3-15	0.2	0.6
All other not included above	IESNA HB	0	0	0

1. Library stacks and locker rooms may use a room cavity ratio (RCR) of > 7 in Table 146 I.

TABLE 140.6-D TAILORED METHOD SPECIAL LIGHTING POWER ALLOWANCES (THIS IS A REFORMATED VERSION OF THE TABLE ABOVE)

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
<u>Primary Function Area</u>	<u>General Illumination Level (Lux)</u>	<u>Wall Display Power (W/ft)</u>	<u>Allowed Combined Floor Display Power and Task Lighting Power (W/ft²)</u>	<u>Allowed Ornamental/Special Effect Lighting</u>
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/Recreation 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 146 H ADJUSTMENTS FOR MOUNTING HEIGHT ABOVE FLOOR

Height in feet above finished floor and bottom of luminaire(s)	Floor Display— Multiply by	Wall Display— Multiply by
≤ 4' 6" or less	1.0	1.0
> 4' 6"	1.2	1.15
≥ 16'	1.4	1.35
≥ 20'	2.0	1.75

TABLE 140.6-E ADJUSTMENTS FOR MOUNTING HEIGHT ABOVE FLOOR

Height in feet above finished floor and bottom of luminaire(s)	Floor Display or Wall Display – Multiply by
≤ 12'	1.00
12' to 16'	1.15
≥ 16'	1.30

TABLE 140.6-F ROOM CAVITY RATIO (RCR) EQUATIONS

Determine the Room Cavity Ratio for Table 140.6-G using one of the following equations.	
Room cavity ratio for rectangular rooms	$RCR = \frac{5 \times H \times (L + W)}{L \times W}$
Room cavity ratio for irregular-shaped rooms	$RCR = \frac{2.5 \times H \times P}{A}$
Where: L = Length of room; W = Width of room; H = Vertical distance from the work plane to the centerline of the lighting fixture; P = Perimeter of room, and A = Area of room	

TABLE 146-I ILLUMINANCE CATEGORIES A THROUGH G LIGHTING POWER DENSITY VALUES (WATTS/FT²)

IESNA Illuminance Category	RCR<3.5	3.5<RCR<7.0	RCR>7.0
A	0.2	0.3	0.4
B	0.4	0.5	0.7
C	0.6	0.8	1.1
D	0.9	1.2	1.4
E	1.3	1.8	2.5
F	2.7	3.5	4.7
G	8.1	10.5	13.7

TABLE 140.6-G ILLUMINANCE LEVEL (LUX) POWER DENSITY VALUES (WATTS/FT²)

Illuminance Level (Lux)	RCR ≤ 2.0	RCR > 2.0 and ≤ 3.5	RCR > 3.5 and ≤ 7.0	RCR > 7.0
50	0.2	0.3	0.4	0.6
100	0.4	0.6	0.8	1.2
200	0.6	0.8	1.3	1.9
300	0.8	1.0	1.4	2.0
400	0.9	1.1	1.5	2.2
500	1.0	1.2	1.6	2.4
600	1.2	1.4	2.0	2.9
700	1.4	1.7	2.3	3.3
800	1.6	1.9	2.6	3.8
900	1.8	2.2	3.0	4.3
1000	1.9	2.4	3.3	4.8

140.7 to 140.8 NR Outdoor Lighting and Signs

SECTION 140.7 – REQUIREMENTS FOR OUTDOOR LIGHTING

~~This section applies to all outdoor lighting, whether attached to buildings, poles, structures or self supporting, including but not limited to, hardscape areas including parking lots, lighting for building entrances, sales and non-sales canopies; lighting for all outdoor sales areas; and lighting for building facades.~~

~~(a) An outdoor lighting installation complies with this section if it meets the requirements in Subsections (b) and (c), and the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under Subsection (d). The allowed outdoor lighting shall be calculated according to Outdoor Lighting Zone in Title 24, Part 1, Section 10-114.~~

EXCEPTIONS to Section 140.7(a): When more than 50 percent of the light from a luminaire falls ~~on~~ within one or more of the following applications, the lighting power for that luminaire shall be exempt from Section 140.7(b):

1. Temporary outdoor lighting.
2. Lighting required and regulated by the Federal Aviation Administration, and the Coast Guard.
3. Lighting for public streets, roadways, highways, and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way.
4. Lighting for sports and athletic fields, and children's playground.
5. Lighting for industrial sites, including but not limited to, rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, and aviation facilities.
6. Lighting specifically for Automated Teller Machines as required by California Financial Code Section 13040, or required by law through a local ordinance.
7. Lighting of public monuments.
8. Lighting of signs shall meet complying with the requirements of Sections 130.3 and 140.8.
- ~~9. Lighting used in or around swimming pools, water features, or other locations subject to Article 680 of the California Electrical Code.~~
- ~~10. Lighting of tunnels, bridges, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.~~
- ~~11. Landscape lighting.~~
- ~~12. In theme parks: outdoor lighting only for themes and special effects.~~
- ~~13. Lighting for outdoor theatrical and other outdoor live performances, provided that these lighting systems are additions to area lighting systems and are controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.~~
- ~~14. Outdoor lighting systems for qualified historic buildings, as defined in the California Historic Building Code (Title 24, Part 8), if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic buildings shall comply with Section 140.7.~~

(ab) Outdoor Lighting Power Trade-offs. Outdoor lighting power trade-offs shall be determined as follows:

1. Allowed lighting power determined according to Section 140.7(d)1 for general hardscape lighting allowance may be traded to specific applications in Section 140.7(d)2, provided the hardscape area from which the lighting power is traded continues to be illuminated in accordance with Section 140.7(d)1A.
2. Allowed lighting power determined according to Section 140.7(d)2 for additional lighting power allowances for specific applications shall not be traded between specific applications, or to hardscape lighting in Section 140.7(d)1.

~~3. Allowed lighting power determined according to Section 147(d)3 for additional lighting power allowances for local ordinance shall not be traded to specific applications in Section 147(d)2 or to hardscape areas not covered by the local ordinance.~~

~~3.4. Trading off lighting power allowances between outdoor and indoor areas shall not be permitted.~~

~~(b) **Outdoor Lighting Power.** An outdoor lighting installation complies with this section if the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under Subsection (d). The allowed outdoor lighting shall be calculated by Lighting Zone as defined in Section 10-114. Local governments may amend lighting zones in compliance with Section 10-114.~~

(c) **Calculation of Actual Lighting Power.** The wattage of outdoor luminaires shall be determined in accordance with Section 130.0(d)(c).

(d) **Calculation of Allowed Lighting Power.** The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accordance with Section 140.7(d)1, and the sum of the additional lighting power allowance for specific applications determined in accordance with Section 140.7(d)2, ~~and the sum of the additional lighting power allowances for local ordinance determined in accordance with Section 147(d)3.~~

1. **General Hardscape Lighting Allowance.** Determine the general hardscape lighting power allowances as follows:
 - A. The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), and other improved area(s) that are illuminated. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is 10 times the luminaire mounting height with the luminaire in the middle of the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines, or obstructed by a structure. The illuminated hardscape area shall include portions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the Area Wattage Allowance (AWA) from TABLE 140.7-A for the appropriate Lighting Zone.
 - B. Determine the perimeter length of the general hardscape area. The total perimeter shall not include portions of hardscape that is not illuminated according to Section 140.7(d)1A. Multiply the hardscape perimeter by the Linear Wattage Allowance (LWA) for hardscape from TABLE 140.7-A for the appropriate lighting zone. The perimeter length for hardscape around landscaped areas and permanent planters shall be determined as follows:
 - i. Landscaped areas completely enclosed within the hardscape area, and which have width or length less than 10 feet wide, shall not be added to the hardscape perimeter length.
 - ii. Landscaped areas completely enclosed within the hardscape area, and which width or length are a minimum of 10 feet wide, the perimeter of the landscaped areas or permanent planter shall be added to the hardscape perimeter length.
 - iii. Landscaped edges that are not abutting the hardscape shall not be added to the hardscape perimeter length.
 - C. Determine the Initial Wattage Allowance (IWA) for general hardscape lighting from TABLE 140.7-A for the appropriate lighting zone. The hardscape area shall be permitted one IWA per site.
 - D. The general hardscape lighting allowance shall be the sum of the allowed watts determined from (A), (B) and (C) above.

2. **Additional Lighting Power Allowance for Specific Applications:** Additional lighting power for specific applications shall be the smaller of the additional lighting allowances for specific applications determined in accordance with TABLE 140.7-B for the appropriate lighting zone, or the actual installed lighting power meeting the requirements for the allowance.

~~3. **Additional Lighting Power Allowance for Local Ordinance Requirements:** For hardscape areas, including parking lots, site roadways, driveways, sidewalks, walkways or bikeways, when specific light levels are required by law through a local ordinance, and provided the local ordinance meets Section 10-114, additional lighting power for those hardscape areas covered by the local ordinance requirement shall be the smaller of the additional lighting allowances for local ordinance determined from TABLE 147-C for the appropriate lighting zone, or the actual installed lighting power meeting the requirements for the allowance.~~

TABLE 140.7-A GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE

Type of Power Allowance	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Area Wattage Allowance (AWA)	0.036 <u>0.035</u> W/ft ²	0.045 W/ft ²	0.092 <u>0.090</u> W/ft ²	0.115 W/ft ²
Linear Wattage Allowance (LWA)	0.36 <u>0.25</u> W/lf	0.45 W/lf	0.92 <u>0.60</u> W/lf	1.15 <u>0.85</u> W/lf
Initial Wattage Allowance (IWA)	340 W	510 W	770 W	1030 W

TABLE 140.7-B ADDITIONAL LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS

All area and distance measurements in plan view unless otherwise noted.

Lighting Application	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.				
Building Entrances or Exits. Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	30 watts	75 60 watts	100 90 watts	120 90 watts
Primary Entrances to Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities. Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	45 watts	80 watts	120 watts	130 watts
Drive Up Windows. Allowance per customer service location. Luminaires qualifying for this allowance shall be within 2 mounting heights of the sill of the window.	40 watts	75 watts	125 watts	200 watts
Vehicle Service Station Uncovered Fuel Dispenser. Allowance per fueling dispenser. Luminaires qualifying for this allowance shall be within 2 mounting heights of the dispenser.	120 watts	175 watts	185 watts	330 watts
WATTAGE ALLOWANCE PER UNIT LENGTH (w/linear ft). May be used for one or two frontage side(s) per site.				
Outdoor Sales Frontage. Allowance for frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides provided that a different principal viewing location exists for each side. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor sales area.	No Allowance	22.5 W/linear ft	36 W/linear ft	45 W/linear ft
WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used for any illuminated hardscape area on the site.				
Hardscape Ornamental Lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 100 watts or less as determined in accordance with Section 130(d), and shall be post-top luminaires, lanterns, pendant luminaires, or chandeliers.	No Allowance	0.02 W/ft ²	0.04 W/ft ²	0.06 W/ft ²
WATTAGE ALLOWANCE PER SPECIFIC AREA (W/ft²). Use as appropriate provided that none of the following specific applications shall be used for the same area.				
Building Facades. Only areas of building façade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the façade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects.	No Allowance	0.18 W/ft ²	0.35 W/ft ²	0.50 W/ft ²
Outdoor Sales Lots. Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other non sales areas shall be considered hardscape areas even if these areas are completely surrounded by sales lot on all sides. Luminaires qualifying for this allowance shall be within 5 mounting heights of the sales lot area.	0.164 W/ft ²	0.555 W/ft ²	0.758 W/ft ²	1.285 W/ft ²
Vehicle Service Station Hardscape. Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. Luminaires qualifying for this allowance shall be illuminating the hardscape area and shall not be within a building, below a canopy, beyond property lines, or obstructed by a sign or other structure.	0.014 W/ft ²	0.155 W/ft ²	0.308 W/ft ²	0.485 W/ft ²
Vehicle Service Station Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	0.514 W/ft ²	1.005 W/ft ²	1.358 1.300 W/ft ²	2.285 2.200 W/ft ²
Sales Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	No Allowance	0.655 W/ft ²	0.908 W/ft ²	1.135 W/ft ²
Non-sales Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	0.084 W/ft ²	0.205 W/ft ²	0.408 W/ft ²	0.585 W/ft ²

Lighting Application	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Guard Stations. Allowance up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentation, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse.	0.154 W/ft ²	0.355 W/ft ²	0.708 W/ft ²	0.985 W/ft ²
Student Pick-up/Drop-off zone. Allowance for the area of the student pick-up/drop-off zone, with or without canopy, for preschool through 12th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked-up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within 2 mounting heights of the student pick-up/drop-off zone.	No Allowance	0.12 W/ft ²	0.45 W/ft ²	No Allowance
Outdoor Dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within 2 mounting heights of the hardscape area of outdoor dining.	0.014 W/ft ²	0.135 W/ft ²	0.258 0.240 W/ft ²	0.435 0.400 W/ft ²
Special Security Lighting for Retail Parking and Pedestrian Hardscape. This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	0.007 W/ft ²	0.009 W/ft ²	0.019 W/ft ²	No Allowance

TABLE 147-C ADDITIONAL LIGHTING POWER ALLOWANCE FOR ORDINANCE REQUIREMENTS

ADDITIONAL LIGHTING POWER ALLOWANCE (W/ft ²) WHEN AVERAGE LIGHT LEVELS ARE REQUIRED BY LOCAL ORDINANCE.				
Required (horizontal foot-candles, AVERAGE)	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
0.5	0	0	0	0
1.0	0.004	0	0	0
1.5	0.024	0.015	0	0
2.0	0.044	0.035	0	0
3.0	0.084	0.075	0.028	0.005
4.0 or greater	0.124	0.115	0.068	0.045
ADDITIONAL LIGHTING POWER ALLOWANCE (W/ft ²) WHEN MINIMUM LIGHT LEVELS ARE REQUIRED BY LOCAL ORDINANCE.				
Required (horizontal foot-candles, MINIMUM)	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
0.5	0.004	0	0	0
1.0	0.044	0.035	0	0
1.5	0.124	0.115	0.068	0.045
2.0	0.164	0.155	0.108	0.085
3.0	0.164	0.155	0.108	0.085
4.0 or greater	0.164	0.155	0.108	0.085

SECTION 140.8 – REQUIREMENTS FOR SIGNS

This section applies to all internally illuminated and externally illuminated signs, unfiltered light emitting diodes (LEDs), and unfiltered neon, both indoor and outdoor. Each sign shall comply with either subsection (a) or (b), as applicable.

(a) Maximum Allowed Lighting Power.

1. For internally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot. For double-faced signs, only the area of a single face shall be used to determine the allowed lighting power.
2. For externally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 2.3 watts per square foot. Only areas of an externally lighted sign that are illuminated without obstruction or interference, by one or more luminaires, shall be used.

3. Lighting for unfiltered light emitting diodes (LEDs) and unfiltered neon shall comply with Section 140.8(b).

(b) Alternate Lighting Sources. The sign shall comply if it is equipped only with one or more of the following light sources:

1. High pressure sodium lamps; or
2. Metal halide lamps that are:
 - A. Pulse start or ceramic served by a ballast that has a minimum efficiency of 88 percent or greater; or
 - B. Pulse start that are 320 watts or smaller, are not 250 watt or 175 watt lamps, and are served by a ballast that has a minimum efficiency of 80 percent.

Where ballast efficiency is the measured output wattage to the lamp divided by the measured operating input wattage when tested according to ANSI C82.6-2005; or

3. Neon or cold cathode lamps with transformer or power supply efficiency greater than or equal to following:
 - A. A minimum efficiency of 75 percent when the transformer or power supply rated output current is less than 50 mA; or
 - B. A minimum efficiency of 68 percent when the transformer or power supply rated output current is 50 mA or greater.

Where the ratio of the output wattage to the input wattage is at 100 percent tubing load; or

4. Fluorescent ~~lamps~~ lighting systems meeting one of the following requirements:

- ~~A. with a~~ A. Use only lamps with a minimum color rendering index (CRI) of 80; ~~or~~
- B. Use only electronic ballasts with a fundamental output frequency not less than 20 kHz; or

5. Light emitting diodes (LEDs) with a power supply having an efficiency of 80 percent or greater; or

EXCEPTION to Section 140.8(b)5: Single voltage external power supplies that are designed to convert 120 volt AC input into lower voltage DC or AC output, and have a nameplate output power less than or equal to 250 watts, shall comply with the applicable requirements of the Appliance Efficiency Regulations (Title 20).

6. Compact fluorescent lamps that do not contain a medium screw base sockets (E24/E26); ~~or~~

~~7. Electronic ballasts with a fundamental output frequency not less than 20 kHz;~~

EXCEPTION 1 to Section 140.8: Unfiltered incandescent lamps that are not part of an electronic message center (EMC), an internally illuminated sign, or an externally illuminated sign.

EXCEPTION 2 to Section 140.8: Exit signs. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.

EXCEPTION 3 to Section 140.8: Traffic Signs. Traffic signs shall meet the requirements of the Appliance Efficiency Regulations.

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 fan 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 non-computer room(s) provided that all of the following are met:

- a. The economizer system is sized to meet the design cooling load of the computer room(s) when the non-computer room(s) are at 50% of their design load; and
 - b. The economizer system has the ability to serve only the computer room(s), e.g. shut off flow to non-computer rooms when unoccupied; and
 - c. The non-economizer system does not operate when the cooling load of the non-computer room(s) served by the economizer system is less than 50% 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.** Non-adiabatic 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% 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.

EXCEPTION 1 to Section 140.9(b)1.B: 75% 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)1.B: 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)2.A: Existing kitchen makeup air units not be 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% of all replacement air is transfer air that would otherwise be exhausted; or
 - ii. Demand ventilation system(s) on at least 75% 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% 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% on at least 50% of the total exhaust airflow; and
- iv. A minimum of 75% 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)2.B: 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 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.

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.

149141.0 NONRESIDENTIAL Additions Alterations Repairs

SUBCHAPTER 6

NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL OCCUPANCIES—ADDITIONS, ALTERATIONS, AND REPAIRS

SECTION 149141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING BUILDINGS THAT WILL BE NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL OCCUPANCIES AND TO EXISTING OUTDOOR LIGHTING FOR THESE OCCUPANCIES AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS

Covered process requirements for additions, alterations and repairs to existing buildings are covered in Section 141.1.

(a) **Additions.** Additions shall meet either Item 1 or 2 below.

1. **Prescriptive approach.** The envelope and lighting of the addition, any newly installed space-conditioning or water-heating system serving the addition, any addition to an outdoor lighting system, and any new sign installed in conjunction with an indoor or outdoor addition shall meet the applicable requirements of Sections 110.0 through 139.5 and Sections 140.2 through 140.89.
2. **Performance approach.**
 - A. The envelope and indoor lighting in the conditioned space of the addition, and any newly installed space-conditioning or water-heating system serving the addition, shall meet the applicable requirements of Sections 110.0 through 139.5; and
 - B. Either:
 - i. The addition alone shall comply with Section 140.1; or
 - ii. The energy use of the combination of the altered existing building plus the proposed addition shall be equal to or less than the energy use of the existing building with all alterations meeting the requirements of Section 149141.0(b)2 plus the standard energy budget of an addition that complies with Section 140.1. Existing plus addition plus alteration. The standard design for existing plus addition plus alteration energy use is the combination of the existing building's unaltered components to remain; existing building altered components that are the more efficient, in TDV energy, of existing conditions or the requirements of Section 141.2(b)2; plus the proposed addition's energy use meeting the requirements of Section 140.1. The proposed design energy use is the combination of existing building's unaltered components to remain and altered components energy features, plus the proposed energy features of the addition.

EXCEPTION 1 to Section 149141.0(a): When heating, cooling, or service water heating to an addition are provided by expanding existing systems, the existing systems and equipment need not comply with Sections 110.0 through 120.9, or Sections 140.4 through 140.5.

EXCEPTION 2 to Section 149141.0(a): Where an existing system with electric reheat is expanded by adding variable air volume (VAV) boxes to serve an addition, total electric reheat capacity may be expanded so that the total capacity does not exceed 150 percent of the existing installed electric heating capacity in any one permit, and the system need not comply with Section 140.4(g). Additional electric reheat capacity in excess of 150 percent of the existing installed electric heating capacity may be added subject to the requirements of the Section 140.4(g).

SECTION 149141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING BUILDINGS THAT WILL BE NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL OCCUPANCIES AND TO EXISTING OUTDOOR LIGHTING FOR THESE OCCUPANCIES AND TO INTERNALLY AND EXTERNALLY ILLUMINATED

EXCEPTION 3 to Section 149141.0-(a): Duct Sealing. When ducts ~~will be~~ extended from an existing duct system to serve the addition, the existing duct system and the extended ducts shall meet the applicable requirements of specified in Section 149141.0(b)1D.

EXCEPTION 4 to Section 141.0(a): The requirements of Section 110.10 shall not apply unless the building has an existing solar zone or unless the building's roof area is increased by 20 percent or more. If the roof area is increased by 20 percent or more, the requirements of Section 110.10 shall apply only to the increased roof area.

(b) **Alterations.** Alterations other than a repair to existing nonresidential, high-rise residential, or hotel/motel buildings, relocatable public school buildings or alterations in conjunction with a change in building occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy not subject to Subsection (a) shall meet either Item 1 or 2 below.

1. **Prescriptive approach.** The altered envelope, space conditioning, lighting and water heating components, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through ~~139~~130.5; and

EXCEPTION to Section 141.0(b)1: The requirements of Section 110.10 shall not apply unless the building has an existing solar zone.

NOTE: Replacement of parts of an existing luminaire, including installing a new ballast or new lamps, without replacing the entire luminaire is not an alteration subject to the requirements of Section 149(b)1.

A. ~~Fenestration a~~Alterations to the building envelope other than repairs -and other than those subject to Section 140.9141.0(b)1B shall ~~comply with~~ meet the applicable ~~requirements~~ subsections i through iii below:

i. For all nonresidential, high-rise residential, and hotel/motel occupancies, when fenestration is not altered or where there are no alterations that increase the fenestration area, all altered components shall meet the requirements of Table 141.0-A-Section 143(a) for the altered component.

EXCEPTION 1 to Section 149141.0(b)1Ai: The RSHGC requirement of Table 141.0-A is not required When:

1. ~~either (1) less than~~ 150 square feet or less of an entire building's fenestration is replaced, or
2. ~~(2) 50 square feet or less of fenestration area is added, or, compliance may be shown with Section 140.9(b)Ai except that the RSHGC requirement of Section 140.3(a)5, or the solar heat gain coefficient of Section 140.3(a)6 is not required.~~
3. 50 square feet or less of skylight is added.

Table 141.0-A Altered Window Minimum U-Factor and RSHG

Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
U-factor	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
RSHGC	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

ii. ~~Nonresidential buildings shall not increase the Overall TDV Energy of the building envelope.~~

iii. ~~For high-rise residential and hotel/motel buildings, alterations shall meet the requirements of Sections 140.3(a)1 through 140.3(a)7.~~

B. Replacements, recovering or recoating of the exterior surface of existing roofs of nonresidential, high-rise residential, and hotels/motels roofs shall meet the requirements of Section 110.8(i) and where: For nonresidential buildings, high-rise residential buildings, and hotels/motels, where roofs with more than 50

percent of the roof or more than 2,000 square feet of roof, whichever is less, is being replaced, recovered or recoated, this altered roof area shall meet the applicable requirements of subsections i. through ~~iv-iii.~~ below.

i. Nonresidential buildings:

a. Low-sloped roofs in climate zones 1 through 16 shall have a minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75, or a minimum SRI of 75.

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 2 through 15 shall have a minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75, or a minimum SRI of 75.

b. Steep-sloped roofs -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.

EXCEPTION 1 TO SECTION 141.0(b)1Bi and ii: Roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are not required to meet the minimum requirements for solar reflectance, thermal emittance, or SRI.

EXCEPTION 2 TO SECTION 141.0(b)1Bia and iia: Roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft².

~~Nonresidential buildings with low-sloped roofs in climate zones 2-15 shall have a minimum aged solar reflectance of 0.55 and a minimum thermal emittance of 0.75, or a minimum SRI of 64.~~

~~ii. **EXCEPTION 3 TO SECTION 0-141.0(b)1Bia and iia:** The aged solar reflectance can be met by using insulation at the roof deck specified in Table 141.0-AB~~

Table 141.0- B Aged Solar Reflectance Insulation Trade-Off Table

<u>Aged Solar Reflectance</u>	<u>Insulation R-value</u>	<u>Aged Solar Reflectance</u>	<u>Insulation R-value</u>
<u>0.62-0.60</u>	<u>2</u>	<u>0.44-0.40</u>	<u>12</u>
<u>0.59-0.55</u>	<u>4</u>	<u>0.39-0.35</u>	<u>16</u>
<u>0.54-0.50</u>	<u>6</u>	<u>0.34-0.30</u>	<u>20</u>
<u>0.49-0.45</u>	<u>8</u>	<u>0.29-0.25</u>	<u>24</u>

~~Nonresidential buildings with steep-sloped roofs in climate zones 2-16 with roofing product density less than 5 pounds per square foot shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16. Buildings with steep-sloped roofs in climate zones 1-16 with roofing product density of 5 pounds per square foot or more shall have a minimum aged solar reflectance of 0.15 and a minimum thermal emittance of 0.75, or a minimum SRI of 10~~

~~iii. High-rise residential buildings and hotels and motels with 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.~~

~~iv~~ⁱⁱⁱ. For nonresidential buildings, high-rise residential buildings and hotels and motels, when low-sloped roofs are exposed to the roof deck or to the roof recover boards, the exposed area shall be insulated to the levels specified in TABLE 141.0-B~~TABLE 149-A~~.

EXCEPTION 1 to Section 149141.0(b)1B~~iv~~ⁱⁱⁱ: The existing roof is insulated with at least R-7 insulation or it has a U-factor lower than 0.089.

EXCEPTION 2 to Section 149141.0(b)1B~~iv~~ⁱⁱⁱ: If mechanical equipment is located on the roof and it will not be disconnected and lifted as part of the roof replacement, insulation added may be limited to the maximum insulation thickness that will allow a height of 8 inches (203 mm) from the roof membrane surface to the top of the base flashing.

EXCEPTION 3 to Section 149141.0(b)1B~~iv~~ⁱⁱⁱ: If adding the required insulation will reduce the base flashing height to less than 8 inches (203 mm) at penthouse or parapet walls, the insulation added may be limited to the maximum insulation thickness that will allow a height of 8 inches (203 mm) from the roof membrane surface to the top of the base flashing, provided that the conditions in subsections i through iv apply:

- i. The penthouse or parapet walls are finished with an exterior cladding material other than the roofing covering membrane material; and
- ii. The penthouse or parapet walls have exterior cladding material that must be removed to install the new roof covering membrane to maintain a base flashing height of 8 inches (203 mm); and
- iii. For nonresidential buildings, the ratio of the replaced roof area to the linear dimension of affected penthouse or parapet walls shall be less than 25 square feet per linear foot for climate zones 2 and 10 through 16, and less than 100 square feet per linear foot for climate zones 1 and 3 though 9; and
- iv. For high-rise residential buildings, hotels or motels, the ratio of the replaced roof area to the linear dimension of affected penthouse or parapet walls shall be less than 25 square feet per linear foot for all climate zones.

EXCEPTION 4 to Section 149141.0(b)1B~~iv~~ⁱⁱⁱ: Tapered insulation may be used which has a thermal resistance less than that prescribed in TABLE 149141.0-B at the drains and other low points, provided that the thickness of insulation is increased at the high points of the roof so that the average thermal resistance equals or exceeds the value that is specified in TABLE 149-A TABLE 141.0-C.

~~**EXCEPTION 1 to Section 149(b)1B**: Roof recoverings allowed by the CBC are not required to meet Section 149(b)1B when all of the following occur:~~

- ~~1. The existing roof has a rock or gravel surface; and~~
- ~~2. The new roof has a rock or gravel surface; and~~
- ~~3. There is no removal of existing layers of roof coverings of more than 50 percent of the roof or more than 2,000 square feet of roof, whichever is less; and~~
- ~~4. There is no recoating with a liquid applied coating; and~~
- ~~5. There is no installation of a recover board, rigid insulation or other rigid, smooth substrate to separate and protect the new roof recovering from the existing roof.~~

EXCEPTION 2-1 to Section 149141.0(b)1B: ~~If the roofing product does not meet the requirements of Section 140.9(b)1B, then T~~the Overall Envelope ~~TDV~~Energy Approach of Section 140.3(b) may be used and the standard building shall be based on the higher roof/ceiling insulation value of the following;

- i. For low-sloped roofs, the insulation values specified in TABLE 149-A TABLE 141.0-CB; or
- ii. For steep-sloped roofs, the insulation values specified in Section 140.3(a); or
- iii. The existing installed insulation.

TABLE 149141.0-CBA-B INSULATION REQUIREMENTS FOR ROOF ALTERATIONS

Climate Zone	Nonresidential		High-rise Residential and Guest Rooms of Hotel/Motel Buildings	
	Continuous Insulation R-value	U-factor	Continuous Insulation R-value	U-factor
1	R-8	0.081	R-14	0.055
2	R-14	0.055	R-14	0.055
3-9	R-8	0.081	R-14	0.055
4	R-8	0.081	R-14	0.055
5	R-8	0.081	R-14	0.055
6	R-8	0.081	R-14	0.055
7	R-8	0.081	R-14	0.055
8	R-8	0.081	R-14	0.055
9	R-8	0.081	R-14	0.055
10-16	R-14	0.055	R-14	0.055
11	R-14	0.055	R-14	0.055
12	R-14	0.055	R-14	0.055
13	R-14	0.055	R-14	0.055
14	R-14	0.055	R-14	0.055
15	R-14	0.055	R-14	0.055
16	R-14	0.055	R-14	0.055

C. New or Replacement sSpace-eCConditioning sSystems or eComponents other than new or replacement ~~space conditioning ducts systems~~ shall meet the requirements of Section 140.4 applicable to the systems or components being altered; and

~~EXCEPTION 1 to Section 140.9(b)1C: For expansions of existing chilled water plants, Section 140.4(i) applies only to expansions of more than 300 tons.~~

EXCEPTION 12 to Section 149141.0(b)1C: For replacements of equivalent or lower capacity electric resistance space heaters for high rise residential apartment units.

EXCEPTION 23 to Section 149141.0(b)1C: For replacement of electric reheat of equivalent or lower capacity electric resistance space heaters, when natural gas is not available.

D. Altered Duct Systems: When new or replacement space-conditioning ducts are installed to serve an existing building, the new ducts shall meet the requirements of Section 120.4, and if they meet the criteria of Sections 140.4(k)1, 2, and 3, the duct system shall be sealed ~~and labeled~~ as confirmed through field verification and diagnostic testing in accordance with procedures for duct sealing of existing duct systems as specified in ~~the~~ Reference Nonresidential Appendix NA2, to meet one of the following requirements:

- i. If the new ducts form an entirely new or replacement duct system directly connected to the air handler, the measured duct leakage shall be equal to or less~~no more~~ than 6 percent of ~~fan-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. Entirely new or replacement duct systems installed as part of an alteration shall be constructed of at least 75% new duct material and may include reused parts from the building's existing duct system (e.g., registers, grilles, boots, air handler, coil, plenums, duct material), but only if the reused parts are accessible and they can be sealed to prevent leakage; or
- 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 ~~fan-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. The duct leakage shall be reduced by more than 60 percent relative to the leakage prior to the equipment having been replaced and a visual inspection shall demonstrate that all accessible leaks have been sealed; or~~
- ~~eb.~~ If it is not possible to meet-comply with the duct leakage criterion duct sealing requirements of Section 141.0(b)1D ~~subsection a or b~~, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS rater utilizing the methods specified in Reference Nonresidential Appendix NA2.1.4.2.2.

EXCEPTION to Section 449141.0(b)1Dii: Duct Sealing. Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos.

- E. **Altered Space Conditioning Systems:** When a space conditioning system is altered by the installation or replacement of space conditioning equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil, ~~or the furnace heat exchanger~~);
 - ~~4i.~~ Existing non-~~setback-UST~~ thermostats shall be replaced with setback-UST thermostats for all altered units. All newly installed space conditioning systems requiring a thermostat shall be equipped with a setback thermostat. All setback thermostats shall meet the requirements of Section 110.2(c); and
 - ~~2ii.~~ Unitary systems with an economizer shall have control systems, including two-stage or electronic thermostats, that cycle compressors off when economizers can provide partial cooling; and
 - ~~iii.~~ The duct system that is connected to the new or replaced space conditioning equipment, if the duct system meets the criteria of Sections 140.4(~~k~~)1, 2, and 3, shall be sealed, 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 ~~the~~ Reference Nonresidential Appendix NA2, to one of the requirements of Section ~~449141.0~~(b)1D.

EXCEPTION 1 to Section 449141.0(b)1E: Duct Sealing. Buildings altered so that the duct system no longer meets the criteria of Sections 144 (~~k~~)1, 2, and 3.

EXCEPTION 2 to Section 449141.0(b)1E: 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.

EXCEPTION 3 to Section 449141.0(b)1E: Duct Sealing. Existing duct systems constructed, insulated or sealed with asbestos.

- 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; and
- G. When the requirements of Section 130.1(~~ed~~)~~2B~~ 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(~~ed~~)~~2D~~~~iii~~.
- H. New internally and externally illuminated signs shall meet the requirements of Sections 110.9, 130.3 and 140.8.
- I. ~~A~~For each enclosed space, a alterations to existing indoor lighting ~~systems~~ shall meet the following requirements, as applicable:
 - ~~1. Alterations that increase the connected lighting load, replace, or remove and re-install a total of 50 percent or more of the luminaires in an enclosed space, shall meet the requirements of Sections 130 and 146; and~~
 - ~~2. The following wiring alterations shall meet the requirements of Sections 119, 131, and 134:~~
 - ~~i. Where new or moved wiring is being installed to serve added or moved luminaires; or~~

- ~~ii. Where conductor wiring from the panel or from a light switch to the luminaires is being replaced, or~~
- ~~iii. Where a lighting panel is installed or relocated.~~

~~3. For an alteration where an existing enclosed space is subdivided into two or more spaces, the new enclosed spaces shall meet the requirements of Sections 131(a) and (d); and~~

~~4. Alterations that have less than 0.5 watts per square foot and increase the existing lighting power density to 0.5 watts per square foot or greater shall meet the requirements of Sections 119, 130, 131, 134, 143(e), and 146.~~

~~i. Lighting System Alterations shall meet the applicable requirements in Table 141.0-C.~~

~~a. Lighting System Alterations shall 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)III:** Alterations that qualify as a Luminaire Modification-in-Place.~~

~~**EXCEPTION 2 to Section 141.0(b)III:** Portable luminaires, luminaires affixed to moveable partitions, and lighting excluded in accordance to Section 140.6(a)3.~~

~~ii. Luminaire Modifications-in-Place shall meet the applicable requirements in Table 141.0-D.~~

~~a. Luminaire Modifications-In-Place shall include only alterations to lighting system meeting the following conditions:~~

~~1. Lighting System Modifications-in-Place shall not part of or the result of any general remodeling or renovation of the enclosed space in which they are located.~~

~~2. Lighting System 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)II(ii)2.** Circuit modifications strictly limited to the addition of occupancy or vacancy sensors and class two lighting controls.~~

~~b. To qualify as a Luminaire Modification-in-Place, lighting systems shall be modified in only one or more of the following methods:~~

~~1. Replacing lamps and/or ballasts.~~

~~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. Installing lighting control systems devices or class 2 wiring for lighting controls only.~~

~~5. Replacement of whole luminaires one for one in which the only electrical modification involves disconnecting the existing luminaire and reconnecting the replacement luminaire.~~

~~iii. 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 circuits 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)Iiii: Lighting Wiring Alterations allowed for Luminaire Modifications-in-Place in accordance with Section 141.0(b)Iiii.

- iv. Any lighting alteration that increases the installed lighting power in an enclosed space shall meet the applicable requirements of Sections 110.9, 130.0, 130.1, 130.4, 140.3(c), and 140.6.
- v. Lighting Alterations and Luminaire Modifications-in-Place shall not exceed the lighting power allowance in Section 140.6.
- vi. 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)Iiii.
 - b. Lighting Alterations that would be the direct cause of asbestos being disturbed.

Exception to Section 141.0(b)Iiii: Lighting alterations made in conjunction with asbestos abatement shall comply with the applicable requirements in Section 141.0(b)II.

- J. Alterations to existing outdoor lighting systems that for any lighting application increase the connected lighting load or replace more than 50 percent of the luminaires shall meet the requirements of Section 147; and shall meet the following requirements, as applicable:
 - i. Alterations that increase the connected lighting load in a lighting application listed in Tables 140.7-A or 140.7-B shall meet the applicable requirements of Section 140.7; and
 - ii. Alterations that replace 10 percent or more of the luminaires in a lighting application listed in Tables 140.7-A or 140.7-B, the altered luminaires in that application shall meet the applicable requirements of Sections 130.0, 130.2, 130.4; and
 - iii. Alterations that replace more than 50 percent of the luminaires in a lighting application listed in Tables 140.7-A or 140.7-B, the lighting in that application shall meet the applicable requirements of Section 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; and

NOTE: 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 ~~140.9~~141.0(b)1K.
- L. New-sService water-heating systems shall meet the requirements of Section 140.5 without solar water heating requirements.
- M. A building shell for which interior walls or ceilings are installed for the first time shall meet the requirements of Section 140.3(c).

2. Mandatory Insulation Requirements for Roofs, Walls, and Floors-

Altered components in a nonresidential, high-rise residential, and hotel/motel buildings shall meet the minimum requirements in this Section.

A. Roof Insulation. The opaque portions of the roof separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 and 2 below:

- 1. **Metal Building-** A minimum of R-19 insulation, or the weighted average U-factor of the roof assembly shall not exceed 0.098.
- 2. **Wood Framed and Others-** A minimum of R-19 insulation between framing members, or the weighted average U-factor of the roof assembly shall not exceed 0.075.

B. Wall Insulation. The opaque portions of framed walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 4 below:

1. **Metal Building-** A minimum of R-13 insulation or the weighted average U-factor of the wall assembly shall not exceed 0.113.
2. **Metal Framed-** A minimum of R-13 insulation between framing members, or the weighted average U-factor of the wall assembly shall not exceed 0.217.
3. **Wood Framed and Others-** A minimum of R-11 insulation between framing members, or the weighted average U-factor of the wall assembly shall not exceed 0.110.
4. **Glass Spandrel Panels and Glass Curtain Walls.-** A minimum of R-4, or the weighted average U-factor of the wall assembly shall not exceed 0.280.

EXCEPTION to Section 141.0(b)2B: Light and heavy mass walls.

C. Floor Insulation. Raised floors separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 3 below:

1. **Raised Framed Floors-** A minimum of R-11 insulation, or the weighted average U-factor of the floor assembly shall not exceed the U-factor of 0.071.
2. **Raised Mass Floors in High-rise Residential and Hotel/Motel Guest Rooms-** A minimum of R-6 insulation, or the weighted average U-factor of the floor assembly shall not exceed the U-factor of 0.111.
3. **Raised Mass Floors in Other Occupancies-** No minimum U-factor requirement.

23. Performance approach.

- A. The altered envelope, space conditioning, lighting and water heating components, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through 120.6 and Sections 120.8 through 130.5~~Sections 110.0 through 139~~; and

EXCEPTION to Section 141.0(b)3A: The requirements of Section 110.10 shall not apply unless the building has an existing solar zone.

- B. ~~When the altered components do not meet the requirements specified in the sections that are stated in subsections i through viii, the standard energy budget (energy budget) shall be based on the requirements stated in those sections as follows: The standard design for an altered component shall be the higher efficiency of existing conditions or the requirements stated in Table 141.0-C. For components not being altered, the standard design shall be based on the existing conditions.~~

TABLE 141.0-C – The Standard Design For An Altered Component

Altered Component	Standard Design Without Third Party Verification of Existing Conditions Shall be Based On	Standard Design With Third Party Verification of Existing Conditions Shall be Based On
<u>Roof/Ceiling Insulation, Wall Insulation, and Floor/Soffit Insulation</u>	<u>The requirements of Section 141.0(b)2.</u>	
<u>Fenestration</u> The allowed glass area shall be the smaller of the subsections a. or b. below: a. _____ The proposed glass area; or b. _____ The larger of: _____ 1. _____ The existing glass area that remains; or _____ 2. _____ The area allowed in Section 140.3(a)5A.	<u>The U-factor and RSHGC requirements of TABLE 141.0-A.</u>	<u>The existing U-factor and RSHGC levels.</u>
<u>Space-Conditioning Equipment and Ducts</u>	<u>The requirements of Sections 141.0(b)1C, 141.0(b)1Di or Section 141.0(b)1Dii, and Section 141.0(b)1E.</u>	
<u>Service Water Heating Systems</u>	<u>The requirements of Section 140.5 without solar water heating requirements.</u>	
<u>Roofing Products</u>	<u>The requirements of Section 141.0(b)1B.</u>	
<u>Lighting System</u>	<u>The requirements of Sections 141.0(b)1F and 141.0(b)1I.</u>	
<u>All Other Measures</u>	<u>The proposed efficiency levels.</u>	

~~i. **Roof/Ceiling Insulation.** The energy budget shall be based on the requirements of TABLE 143-A, TABLE 143-B, and TABLE 143-C.~~

~~ii. **Roofing Products.** The energy budget shall be based on the requirements of Section 149(b)1B.~~

~~iii. **Wall Insulation.** The energy budget shall be based on the requirements of TABLE 143-A, TABLE 143-B, and TABLE 143-C.~~

~~iv. **Floor/Soffit Insulation.** The energy budget shall be based on the requirements of TABLE 143-A, TABLE 143-B, and TABLE 143-C.~~

~~v. **Fenestration.** The energy budget shall be based on the U-factor and SHGC value requirements of TABLE 143-A, TABLE 143-B, and TABLE 143-C. The allowed glass area shall be the smaller of the subsections a and b below:~~

~~a. The proposed glass area~~

~~b. The larger of:~~

~~_____ 1. _____ The existing glass area; or~~

~~_____ 2. _____ The area allowed in Section 143(a)5A.~~

~~vi. **Space-Conditioning Equipment and Ducts.** The energy budget shall be based on the requirements of Sections 149(b)1C, 149(b)1Di or Section 149(b)1Dii, and Section 149(b)1E.~~

~~vii. **Service Water Heating Systems.** The energy budget shall be based on requirements of Section 145.~~

~~viii. **Lighting.** The energy budget shall be based on the requirements of Sections 149(b)1F and 149(b)1I.~~

- C. ~~When the altered components meet the requirements specified in the sections that are stated in Section 149(b)2B, subsections i through viii, the standard energy budget shall be based on existing conditions. The proposed design shall be based on the actual values of the altered components.~~
- D. ~~When the altered component's existing conditions exceed the requirements specified in subsection i through viii above, the standard design shall be based on existing conditions.~~
- E. ~~The proposed design shall be based on the actual values of the altered components.~~

NOTES TO SECTION ~~149~~141.0(b)32:

- A1. If an existing component must be replaced with a new component, that component is considered an altered component for the purpose of determining the energy budget and must meet the requirements of Section ~~149~~141.0(b)32.
- B. ~~The proposed design shall be based on the actual values of the altered components.~~
- C2. The standard design shall assume the same geometry and orientation as the proposed design.
3. The "existing efficiency level" modeling rules, including situations where nameplate data is not available, are described in the Nonresidential ACM Manual.
- D. ~~The performance approach of Section 149(b)2 may not be used when Exception 1 or 2 to Section 149(b)1Biv are used.~~

EXCEPTION 1 to Section ~~149~~141.0 (b): When heating, cooling or service water heating for an alteration are provided by expanding existing systems, the existing systems and equipment need not comply with Sections 110 through 120.9 and Section 140.4 or 140.5.

EXCEPTION 2 to Section ~~149~~141.0 (b): When existing heating, cooling or service water heating systems or components are moved within a building, the existing systems or components need not comply with Sections 110.0 through 120.9 and Section 140.4 or 140.5.

EXCEPTION 3 to Section ~~149~~141.0 (b): Where an existing system with electric reheat is expanded when adding variable air volume (VAV) boxes to serve an alteration, total electric reheat capacity may be expanded not to exceed 20 percent of the existing installed electric capacity in any one permit and the system need not comply with Section 140.4(g). Additional electric reheat capacity in excess of 20 percent may be added subject to the requirements of the Section 140.4(g).

Note: Relocation or moving of a relocatable public school building is not considered an alteration for the purposes of complying with Title 24, Part 6. If an alteration is made to envelope, space conditioning, lighting or water heating components of a relocatable public school building, the alteration is subject to Section ~~149~~141.0 (b).

- (c) Repairs. Repairs shall not increase the preexisting energy consumption of the repaired component, system, or equipment.
- (d) Alternate Method of Compliance. Any addition, alteration, or repair may comply with the requirements of Title 24, Part 6 by meeting the applicable requirements for the entire building.

Table 141.0-D Requirements for Luminaire Alterations

<u>Quantity of existing affected luminaires per Enclosed Space ¹</u>	<u>Resulting Lighting Power</u>	<u>Applicable Mandatory Control Provisions for Each Enclosed Space</u>	<u>Multi-level Lighting Control Requirements for Each Enclosed Space</u>
<u>Alterations that do not change the area of the enclosed space or the space type</u>			
<u>None</u>	<u>Existing lighting power is permitted</u>	<u>Existing provisions are permitted</u>	<u>Existing controls are permitted</u>
<u>Sum total ≥ 10% of existing luminaires</u>	<u>≤ 85% of allowed lighting power per Section 140.6 Area Category Method</u>	<u>§130.1(a), (c)</u>	<u>Two level lighting control ² or §130.1(b)</u>
	<u>> 85% of allowed lighting power per Section 140.6 Area Category Method</u>	<u>§130.0(d) §130.1(a), (c), (d)</u>	<u>§130.1(b)</u>
<u>Alterations that change the area of the enclosed space or the space type or increase the lighting power in the enclosed space</u>			
<u>Any number</u>	<u>Comply with Section 140.6</u>	<u>§130.0(d) §130.1(a), (c), (d), (e)</u>	<u>§130.1(b)</u>
<p><u>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)II(i).</u></p> <p><u>2. Two level lighting control shall have at least one control step between 30 and 70% of design lighting power in a manner providing reasonably uniform illuminations</u></p>			

Table 141.0-E Requirements for Luminaire Modifications-in-Place

<p>For compliance with this Table, building space is defined as any of the following:</p> <p><u>1. A complete single story building</u></p> <p><u>2. A complete floor of a multi floor building</u></p> <p><u>3. The entire space in a building of a single tenant under a single lease</u></p> <p><u>4. All of the common, not leasable space in single building</u></p>			
<u>Quantity of affected luminaires per Building Space per annum</u>	<u>Resulting Lighting Power per Building Space Each Enclosed Building Space Where ≥ 10% of Existing Luminaires are Luminaire Modifications-in-Place</u>	<u>Applicable mandatory control provisions for each enclosed space ¹</u>	<u>Applicable multi-level lighting control requirements for each enclosed space ²</u>
<u>Sum total ≥ 40 Luminaire Modifications-in-Place</u>	<u>≤ 85% of allowed lighting power per Section 140.6 Area Category Method</u>	<u>§130.1(a), (c)</u>	<u>Two level lighting control ³ Or §130.1(b)</u>
	<u>> 85% of allowed lighting power per Section 140.6 Area Category Method</u>	<u>§130.0(d) §130.1(a), (c), (d)</u>	<u>§130.1(b)</u>
<p><u>1. Control requirements only apply to enclosed spaces for which there are Luminaire Modifications-in-Place.</u></p> <p><u>2. Multi-level controls are required only for luminaires for which there are Luminaire Modifications-in-Place.</u></p> <p><u>3. Two level lighting control shall have at least one control step between 30 and 70% of design lighting power in a manner providing reasonably uniform illuminations</u></p>			

SECTION 141.1 – REQUIREMENTS FOR COVERED PROCESSES IN ADDITIONS, ALTERATIONS TO EXISTING BUILDINGS THAT WILL BE NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL OCCUPANCIES

- (a) Refrigerated Warehouses.** A refrigerated warehouse complies with this section if it complies with the applicable requirements of Sections 120.6(a).
- (b) Commercial Refrigeration.** Commercial refrigeration systems comply with this section if they comply with the applicable requirements of Sections 120.6(b).
- (c) Enclosed Parking Garages.** An enclosed parking garage complies with this section if it complies with the applicable requirements of Sections 120.6(c).
- (d) Process Boilers.** A process boiler complies with this section if it complies with the applicable requirements of Sections 120.6(d).
- (e) Compressed Air Systems.** Compressed air systems comply with this section if they comply with the applicable requirements of Sections 120.6(e).

150150.0 Residential Mandatory Features

SUBCHAPTER 7

LOW-RISE RESIDENTIAL BUILDINGS – MANDATORY FEATURES AND DEVICES

SECTION 150150.0 – MANDATORY FEATURES AND DEVICES

Any newly ~~construction-constructed~~ in a low-rise residential building shall meet the requirements of this Section. High-rise residential dwelling units shall meet the applicable requirements of Sections 150.0(i) and 150.0(k). Hotel and motel guest rooms shall meet the requirements of Sections 150.0(i), 150.0(k), and 150.0(f).

- (a) **Ceiling Insulation.** The opaque portions of ceilings separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of either ~~item 1 or 2~~ and 3 below:
1. Ceilings shall be insulated between wood-framing members with insulation resulting in an installed thermal resistance of R-19 or greater for the insulation alone.
~~AL~~EXCEPTION ~~R~~NATIVE to Section 150150.0(a)1: Continuous ~~I~~nsulation which is not penetrated by framing members may-shall meet an R-value equivalent to installing R-19 insulation between wood-framing members and accounting for including the thermal effects of framing members.
 2. The weighted average U-factor of ceilings shall not exceed the U-factor that would result from installing R-19 insulation between wood-framing members in the entire ceiling and accounting for the effects of framing members.
 3. Permanently attach rigid board, ~~insulation or batt,~~ or blanket insulation to the access door using adhesive or mechanical fastener. The attic access shall be gasketed to prevent air leakage.
- ~~†~~
- (b) **Loose-fill Insulation.** When loose-fill insulation is installed, the minimum installed weight per square foot shall conform with the insulation manufacturer's installed design weight per square foot at the manufacturer's labeled R-value.
- (c) **Wall Insulation.** The opaque portions of frame walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of either ~~item 1, 2, or 3~~ below, plus item 3:
1. Wood-framed walls shall be insulated between framing members with insulation having an installed thermal resistance of R-13 or greater. Framed foundation walls of heated basements or heated crawl spaces shall be insulated above the adjacent outside ground line with insulation having an installed thermal resistance of at least R-13.
EXCEPTION to Section 150150.0(c)1: Continuous ~~I~~nsulation which is not penetrated by framing members may meet an R-value equivalent to installing R-13 insulation between wood-framing members and accounting for including the thermal effects of framing members.
 2. The weighted average U-factor of walls shall not exceed the U-factor that would result from installing R-13 insulation between wood-framing members and accounting for the effects of framing members.
EXCEPTION to Section 150(c)1 and 2: Existing walls already insulated with R-11, achieving compliance with R-11 using a performance compliance method, are exempt from meeting the requirements of 150(c)1 & 2.

3. Bay Window roofs and floors shall be insulated to meet the wall insulation requirements of ~~Package-Table 150.1-A~~.

(d) **Raised-floor Insulation.** Raised floors separating conditioned space from unconditioned space shall meet the requirements of either Item 1 or 2 below:

1. Floors shall be insulated between wood-framing members with insulation having an installed thermal resistance of R-~~19~~13 or greater.
2. The weighted average U-factor of floor assemblies shall not exceed the U-factor that would result from installing R-~~19~~13 insulation between wood-framing members and accounting for the effects of framing members.

~~EXCEPTION ALTERNATIVE to Section 150150.0(d)1 and 2: A building with a controlled ventilation crawlspace~~ Raised floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums as shown in ~~TABLE 151-B and TABLE 151-C, TABLE 151-D~~ TABLE 150.1-A and a Class I or Class II vapor retarder barrier is placed over the entire floor of the crawl-space, and vents are fitted with automatically operated louvers that are temperature actuated. See Reference Residential Appendix RA4.5.1 for additional requirements.

(e) **Installation of Fireplaces, Decorative Gas Appliances and Gas Logs**

1. If a masonry or factory-built fireplace is installed, it shall have the following:
 - A. Closeable metal or glass doors covering the entire opening of the firebox;
 - B. A combustion air intake to draw air from the outside of the building, which is at least 6 square inches in area and is equipped with a readily accessible, operable, and tight-fitting damper or combustion-air control device; and

EXCEPTION to Section 150150.0(e)1B: An outside combustion-air intake is not required if the fireplace will be installed over concrete slab flooring and the fireplace will not be located on an exterior wall.

- C. A flue damper with a readily accessible control.

EXCEPTION to Section 150150.0(e)1C: When a gas log, log lighter, or decorative gas appliance is installed in a fireplace, the flue damper shall be blocked open if required by the CMC or the manufacturer's installation instructions .

2. Continuous burning pilot lights and the use of indoor air for cooling a firebox jacket, when that indoor air is vented to the outside of the building, are prohibited.

(f) ~~Air IF a shall be installed on the building envelope it shall~~

~~Retarding Wrap. If an air retarding wrap is installed to meet the compliance credit under performance approach, it shall be tested and labeled by the manufacturer to comply with ASTM E1677-95, Standard Specification for an Air Retarder (AR) Material or system for Low-Rise Framed Building Walls, and have a minimum perm rating of 10. The air retarding wrap shall be installed per the manufacturer's specifications that shall be provided to comply with ASTM E1677-95 (2000).~~ Hotel and Motel Guest Rooms:

1. Permanently installed lighting shall:

A. Meet the applicable requirements of Section 150.0(k); and

B. 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 150.0(f)1B: 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.

2. Space-conditioning system controls shall:

A. Meet the applicable requirements of Section 120.2(c); and

B. Have captive card key automatic controls, occupancy sensing controls, or automatic controls such that, no longer than 30 minutes after the guest room has been vacated, setpoints are setup at least +5°F (+3°C) in cooling mode and set-down at least -5°F (-3°C) in heating mode.

3. At least one-half of the 120-volt receptacles in each guest room shall be controlled receptacles. Controlled receptacles shall meet the applicable requirements of Section 130.5(d)1, 2, 3, and 5. Electric circuits serving controlled receptacles shall have captive card key automatic 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.

(g) **Vapor ~~Barriers~~ Retarder**

1. In Climate Zones 14 and 16 shown in FIGURE 101-A, a Class II vapor barrier-retarder shall be installed on the conditioned space side of all insulation in all exterior walls, vented attics, and unvented attics with air-impermeable insulation; and

2. In Climate Zones 1-16 with unvented crawl spaces the earth floor of the crawl space shall be covered with a Class I or Class II vapor retarder to protect insulation from condensation; or

3. If a building has a controlled ventilation crawl space, a Class I or Class II vapor barrier-retarder shall be placed over the earth floor of the crawl space to reduce moisture entry and protect insulation from condensation, as specified in the alternative exception to Section 450150.0(d).

(h) **Space-Conditioning Equipment.**

1. Building Cooling and Heating Loads.

Building heating and cooling loads shall be determined using a method based on any one of the following:

- A. The ASHRAE Handbook, Equipment Volume, Applications Volume, and Fundamentals Volume, or
- B. The SMACNA Residential Comfort System Installation Standards Manual, or
- C. The ACCA Manual J.

The cooling and heating loads are two of the criteria that shall be used for equipment sizing and selection.

NOTE: Heating systems are required to have a minimum heating capacity adequate to meet the minimum requirements of the CBC. The furnace output capacity and other specifications are published in the Commission's directory of certified equipment or other directories approved by the Commission.

2. Design conditions.

For the purpose of sizing the space-conditioning (HVAC) system, the indoor design temperatures shall be 68 70°F for heating and 75°F for cooling. Outdoor design conditions shall be selected from Reference Joint Appendix JA2, which is based on data from the ASHRAE Climatic Data for Region X. The outdoor design temperatures for heating shall be no lower than the Heating Winter Median of Extremes values. The outdoor design temperatures for cooling shall be no greater than the 1.0 percent Cooling Dry Bulb and Mean Coincident Wet Bulb values.

3. Outdoor Condensing Units.

Clearances. Installed air conditioner and heat pump outdoor condensing units shall have a clearance of at least five (5) feet from the outlet of any dryer vent.

4. Central Forced-Air Heating Furnaces.

Temperature Rise. Central forced-air heating furnace installations shall be configured to operate in conformance with the furnace manufacturer's maximum inlet-to-outlet temperature rise specifications.

(i) **Thermostats.** Heating systems shall be equipped with thermostats that meet the setback thermostat requirements of Section 110.2(c).

(j) **Water System Piping and Insulation for Piping, and Tanks, Insulation and Cooling Systems Lines Insulation.**1. **Storage tank insulation.**

- A. Storage gas water heaters with an energy factor equal to or ~~less-greater~~ than the federal minimum standards shall be externally wrapped with insulation having an installed thermal resistance of R-12 or greater.
- B. Unfired hot water tanks, such as storage tanks and backup storage tanks for solar water-heating systems, shall be externally wrapped with insulation having an installed thermal resistance of R-12 or greater or have internal insulation of at least R-16 and a label on the exterior of the tank showing the insulation R-value.

2. **Water piping and cooling system line insulation thickness and conductivity.** Piping shall be insulated to the thicknesses as follows:

A. All domestic hot water system piping conditions listed below, whether buried or unburied, must be insulated and the insulation thickness shall be selected based on the conductivity range in TABLE 120.3-A and the insulation level shall be selected from the fluid temperature range based on the thickness requirements in TABLE 120.3-A.

- i. The first 5 feet (1.5 meters) of hot and cold water pipes from the storage tank.
- ii. All piping with a nominal diameter of 3/4 inch (19 millimeter) or larger.
- iii. All piping associated with a domestic hot water recirculation system regardless of the pipe diameter.
- iv. Piping from the heating source to storage tank or between tanks.
- v. Domestic hot water pipes that are buried below grade.

B. In addition to insulation requirements, all domestic hot water pipes that are buried below grade must be installed in a water proof and non-crushable casing or sleeve that allows for installation, removal, and replacement of the enclosed pipe and insulation.

C. Pipe for cooling system lines shall be insulated as specified in subsection A. Piping for steam and hydronic heating systems or hot water systems with pressure above 15 psig (103 kPa) shall meet the requirements in TABLE 123-A.

~~for recirculating sections of domestic hot water systems; piping from the heating source to the storage tank for an indirect fired domestic water heating system; the first 5 feet (1.5 m) of hot and cold water pipes from the storage tank for nonrecirculating systems; all nonrecirculating hot water piping of nominal diameter 3/4 inch (19 mm) or larger; and cooling system lines shall be thermally insulated as specified in subsection A or B. Piping for steam and hydronic heating systems or hot water systems with pressure above 15 psig shall meet the requirements in TABLE 123-A.~~

~~A. For insulation with conductivity in the range shown in TABLE 150-A TABLE 150.0-A for the applicable fluid temperature range, the insulation shall have the applicable thickness shown in TABLE 150-B TABLE 150.0-B.~~

~~B. For insulating with an alternate material with conductivity outside the range shown in TABLE 150-A for the applicable fluid temperature range, the insulation shall have a minimum thickness as calculated by EQUATION A~~

~~EQUATION 150-A — INSULATION THICKNESS~~

$$T = PR \left[1 + \frac{t}{PR} \frac{K}{k} \right]$$

~~WHERE:~~

- ~~T = Minimum insulation thickness for alternate material with conductivity K, inches.~~
- ~~PR = Pipe actual outside radius, inches.~~
- ~~t = Insulation thickness from TABLE 150-B, inches.~~
- ~~K = Conductivity of alternate material at the mean rating temperature indicated in TABLE 150-A for the applicable fluid temperature range, in Btu-inch per hour per square foot per °F.~~
- ~~k = The lower value of the conductivity range listed in TABLE 150-A for the applicable fluid temperature range, Btu-inch per hour per square foot per °F.~~

EXCEPTION 1 to Section 150150.0(j)2: Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

EXCEPTION 2 to Section 150150.0(j)2: Piping that serves process loads, gas piping, cold domestic water piping, condensate drains, roof drains, vents, or waste piping.

EXCEPTION 3 to Section 150150.0(j)2: Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing. Insulation shall butt securely against all framing members.

EXCEPTION 4 to Section 150150.0(j)2: Piping installed in interior or exterior walls shall not be required to have pipe insulation if all of the requirements are met for compliance with ~~the Quality~~ Insulation Installation (QII) ~~Quality compliance option~~ as specified ~~in~~ by the ~~Reference~~ Residential ACM Manual ~~Appendix RA3.5~~.

EXCEPTION 5 to Section 150150.0(j)2: Piping installed in attics with a minimum of 4 inches (10 cm) of attic insulation on top of the piping shall not be required to have pipe insulation.

NOTE: Where the Executive Director approves a water heater calculation method for a particular water heating recirculation system, piping insulation requirements are those specified in the approved calculation method.

3. **Insulation Protection.** Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind. ~~Protection~~ ~~includings~~ but ~~is~~ not limited to the following:
 - A. Insulation exposed to weather shall be suitable for outdoor service; e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
 - B. Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall ~~have a~~ ~~include a~~ Class I or Class II vapor retarder ~~ing facingant located outside the insulation, or the insulation shall be installed at the thickness that meets~~ qualifies as a Class I or Class II vapor retarder ~~(unless the insulation is inherently vapor retardant), and all penetrations and joints of which shall be sealed.~~
4. ~~Solar water heating systems and/or collectors shall be certified by the Solar Rating and Certification Corporation.~~

~~54. The maximum length of 1 inch (25 mm) piping in a non-recirculating domestic hot water distribution system shall be limited to a total length of 15 feet (4.5 m).~~

~~**EXCEPTION 1 to Section 150150.0(j)54:** A dedicated 1 inch (25 mm) line feeding a high flow tub fixture (or tub fixtures) can be installed provided all other fixtures meet the requirement of 150150.0(j)54.~~

~~56. Solar water heating systems and/or collectors shall be certified and rated by the Solar Rating and Certification Corporation (SRCC) or by a testing agency approved by the Executive Director.~~

(k) **Residential Lighting.**

1. **High Efficacy Luminaire Requirements**

A. **Luminaire Efficacy:** Installed luminaires shall be classified as high-efficacy or low-efficacy for compliance with Section 150.0(k) in accordance with Table 150.0-A or Table 150.0-B, as applicable.

B. **Hybrid Luminaires:** When a high efficacy and low efficacy lighting system are combined together in a single luminaire, the high efficacy and low efficacy lighting systems shall separately comply with the applicable provisions of Section 150.0(k).

~~A high efficacy luminaire or LED Light Engine with Integral Heat Sink has an efficacy that is no lower than the efficacies contained in TABLE 150-C and is not a low efficacy luminaire as specified by Section 150(k)2.~~

~~**EXCEPTION 1 to Section 150(k)1:** To qualify as high efficacy, a luminaire rated only for use with a high intensity discharge reflector lamp shall have a minimum lamp efficacy within 2 lumens per watt of the minimum lamp efficacies in TABLE 150-C.~~

~~**EXCEPTION 2 to Section 150(k)1:** When a high efficacy LED Light Engine with Integral Heat Sink is combined with a low efficacy lighting system in a Hybrid LED Luminaire as defined in Section 101, the high efficacy and low efficacy lighting systems shall separately comply with the applicable provisions of Section 150(k).~~

2. **Low Efficacy Luminaires.** A low efficacy luminaire is any luminaire that does not qualify as high efficacy as specified by Section 150(k)1, or any of the following regardless of the efficacy:

A. ~~Contains a medium screw base socket (E24/E26) or other line voltage socket or a line voltage lamp holder; or~~

~~**EXCEPTION 1 to Section 150(k)2A:** High intensity discharge (HID) luminaires containing factory installed ballasts and HID rated medium screw base sockets shall be considered high efficacy luminaires provided they meet the efficacies contained in TABLE 150-C.~~

~~**EXCEPTION 2 to Section 150(k)2A:** A Luminaire with a factory installed GU 24 lamp holder may be classified as high efficacy provided that it meets all of the following requirements:~~

~~i. Is not a recessed downlight that is rated to be used with compact fluorescent lamps; and~~

~~ii. Does not contain any other type of line voltage socket or lamp holder; and~~

~~iii. The manufacturer does not make available adaptors or modular components for the luminaire which convert the GU 24 lamp holder to any other type of socket or lamp holder; and~~

~~iv. Is rated, as specified by UL 1598, for use only with high efficacy lamps or high efficacy LED Light Engine with Integral Heat Sink meeting the requirements contained in TABLE 150-C, as listed on a permanent, pre-printed, factory installed label on the luminaire housing.~~

~~B. Low voltage incandescent lighting; or~~

~~C. Track lighting or other lighting systems which allow the addition or relocation of luminaires without altering the wiring of the system; or~~

~~D. Lighting systems which have modular components that allow conversion between screw-based and pin-based sockets without changing the luminaires' housing or wiring; or~~

~~E. Electrical boxes finished with a blank cover or where no electrical equipment has been installed, and where the electrical box can be used for a luminaire or a surface mounted ceiling fan.~~

~~3C. **Luminaire Wattage.** The wattage of permanently installed luminaires in residential kitchens shall be determined as specified by in accordance with Section 130.0(d). In residential kitchens, the wattage of electrical boxes finished with a blank cover or where no electrical equipment has been installed, and where~~

the electrical box can be used for a luminaire or a surface mounted ceiling fan, shall be calculated as 180 watts of low efficacy lighting per electrical box.

4D. Electronic Ballasts. Ballasts for fluorescent lamps rated 13 watts or greater shall be electronic and shall have an output frequency no less than 20 kHz.

5E. Night Lights. Permanently installed night lights and night lights integral to a permanently installed luminaire or exhaust fan shall meet one of the following conditions:

~~A. Shall contain only high efficacy lamps meeting the minimum efficacies contained in TABLE 150-C and shall not contain a line voltage socket or line voltage lamp holder; or~~

~~B. Shall be rated to consume no more than five watts of power per luminaire and exhaust fan as determined by as determined in accordance with Section 130.0(dc), and shall not contain a medium screw base socket.~~

6F. Lighting Integral to Exhaust Fans. Lighting integral to exhaust fans, in rooms other than kitchens, shall meet the applicable requirements of Section 150.0(k).

EXCEPTION to Section 150.0(k)1F: Lighting installed by the manufacturer in kitchen exhaust hoods.

72. Switching Devices and Controls.

A. ~~All permanently installed high~~ high efficacy luminaires shall be switched separately from low efficacy luminaires.

B. ~~All exhaust~~ exhaust fans shall be switched separately from lighting system(s).

EXCEPTION to Section 150(k)72B: Lighting integral to an exhaust fan may be on the same switch as the fan. An exhaust fan with an integral lighting system provided where the lighting system can be manually turned on and off switched OFF in accordance with the applicable provisions in Section 150(k)2 while allowing the fan to continue to operate for an extended period of time.

C. ~~All permanently installed~~ luminaires shall be switched with readily accessible controls that permit the luminaires to be manually switched ~~on~~ ON and ~~off~~ OFF.

D. ~~All~~ lighting controls and equipment shall be installed in accordance with the manufacturer's instructions.

E. ~~No controls shall bypass a dimmer or vacancy sensor function. A lighting circuit controlled by more than one switch where that~~ dimmer or ~~manual on occupant~~ vacancy sensor has been installed to comply with Section 150.0(k) shall meet the following conditions:

~~i. No controls shall bypass the dimmer or manual on occupant sensor function.~~

~~ii. The dimmer or manual on occupant sensor shall comply with the applicable requirements of Section 119.~~

F. ~~Manual on occupant sensors, motion sensors, and dimmers~~ Lighting controls installed to comply with Section 150(k) shall comply with the applicable requirements of Section 110.9.

G. An Energy Management Control System (EMCS) may be used to comply with dimmer requirements in Section 150.0(k) if at a minimum it provides the functionality of a dimmer in accordance with Section 110.9, meets the acceptance test requirements in Section 130.4, the EMCS requirements in Section 130.5, and complies with all of the applicable requirements in Section 150.0(k)2.

H. An Energy Management Control System (EMCS) may be used to comply with vacancy sensor requirements in Section 150.0(k) if at a minimum it provides the functionality of a vacancy sensor in accordance with Section 110.9, meets the acceptance test requirements in Section 130.4, the EMCS requirements in Section 130.5, and complies with all of the applicable requirements in Section 150.0(k)2.

I. A multi-scene programmable controller may be used to comply with dimmer requirements in Section 150.0(k) if at a minimum it provides the functionality of a dimmer in accordance with Section 110.9, and complies with all of the applicable requirements in Section 150.0(k)2.

83. Lighting in Kitchens.

A. A minimum of 50 percent of the total rated wattage of permanently installed lighting in kitchens shall be high efficacy.

~~EXCEPTION to Section 150.0(k)87A:~~ Up to 50 watts for dwelling units less than or equal to 2,500 ft² or 100 watts for dwelling units larger than 2,500 ft² may be exempt from the 50 percent high efficacy requirement when the following conditions are met:

- ~~A.~~ All low efficacy luminaires in the kitchen ~~150.0~~ are controlled by a manual on-occupant sensor, dimmer, energy management control system (EMCS), or a multi-scene programmable control system; and
- ~~B.~~ All permanently installed luminaires in garages, laundry rooms, closets greater than 70 square feet, and utility rooms are high efficacy and are controlled by a manual on-occupant sensor.

~~NOTE:~~ ~~B.~~ For the purpose of ~~of this requirement~~ compliance with Section 150.0(k), kitchen lighting includes all permanently installed lighting in the kitchen except for lighting that is internal to cabinets for the purpose of illuminating only the inside of the cabinets. Lighting in areas adjacent to the kitchen, including but not limited to dining and nook areas, are considered kitchen lighting if they are not separately switched from kitchen lighting.

~~EXCEPTION to Section 150.0(k)3:~~ Up to 50 watts for dwelling units less than or equal to 2,500 ft² or 100 watts for dwelling units larger than 2,500 ft² may be exempt from the 50 percent high efficacy requirement when all lighting in the kitchen is controlled in accordance with the applicable provisions in Section 150.0(k)2, and is also controlled by vacancy sensors or dimmers.

~~94.~~ **Lighting Internal to eCabinets.** Permanently installed lighting that is internal to cabinets shall use no more than 20 watts of power per linear foot of illuminated cabinet. The length of an illuminated cabinet shall be determined using one of the following measurements, regardless of the number of shelves or the number of doors per cabinet section:

- ~~A.~~ One horizontal length of illuminated cabinet; or
- ~~B.~~ One vertical length, per illuminated cabinet section; or
- ~~C.~~ No more than one vertical length per every 40 horizontal inches of illuminated cabinet.

~~5.~~ **Lighting in Bathrooms.** Lighting installed in bathrooms shall meet the following requirements:

- ~~A.~~ A minimum of one high efficacy luminaire shall be installed in each bathroom; and
- ~~B.~~ All other lighting installed in each bathroom shall be high efficacy or controlled by vacancy sensors.

~~106.~~ **Lighting in Bathrooms, Garages, Laundry Rooms, Closets, and Utility Rooms.** Permanently ~~Lighting~~ installed luminaires in ~~bathrooms~~, attached and detached garages, laundry rooms, ~~closets~~ and utility rooms shall be high efficacy luminaires.

~~EXCEPTION 1 to Section 150(k)10:~~ Permanently installed low efficacy luminaires shall be allowed provided that they are controlled by a manual on-occupant sensor certified to comply with the applicable requirements of Section 119.

~~EXCEPTION 2 to Section 150(k)10:~~ Permanently installed low efficacy luminaires in closets less than 70 square feet are not required to be controlled by a manual on-occupant sensor.

~~117.~~ **Lighting other than in Kitchens, Bathrooms, Garages, Laundry Rooms, Closets, and Utility Rooms.** ~~Permanently Lighting~~ installed luminaires ~~located~~ in rooms or areas other than in kitchens, bathrooms, garages, laundry rooms, ~~closets~~, and utility rooms shall be high efficacy ~~luminaires~~, or shall be controlled by either dimmers or vacancy sensors.

~~EXCEPTION 1 to Section 150.0(k)7:~~ Luminaires in closets less than 70 square feet.

~~EXCEPTION 1 to Section 150(k)11:~~ Permanently installed ~~Low~~ efficacy luminaires shall be allowed provided they are controlled by either a dimmer switch that complies with the applicable requirements of Section 119, or by a manual on-occupant ~~vacancy~~ sensor that complies with the applicable requirements of Section 119.

~~EXCEPTION 2 2 to Section 150.0(k)1127:~~ Lighting in detached storage buildings less than 1000 square feet located on a residential site ~~is not required to comply with Section 150(k)11.~~

~~8132.~~ **Recessed Luminaires in Insulated Ceilings.** Luminaires recessed into ~~insulated~~ ceilings shall meet all of the following ~~conditions~~ requirements:

- A. Be listed, as defined in Section 100.1, for zero clearance insulation contact (IC) by Underwriters Laboratories or other nationally recognized testing/rating laboratories; and
- B. Have a label that certifies that the luminaire is airtight with air leakage less than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283. ~~An exhaust fan housing shall not be required to be certified airtight;~~ and

~~**EXCEPTION to Section 150(k)123B:** An exhaust fan housing shall not be required to be certified airtight.~~

- C. Be sealed with a gasket or caulk between the luminaire housing and ceiling, and shall have all air leak paths between conditioned and unconditioned spaces sealed with a gasket or caulk; and

~~Note: An exhaust fan shall be sealed with a gasket or caulk between the exhaust fan housing and ceiling.~~

- D. For recessed **compact fluorescent** luminaires with ballasts to qualify as high efficacy for compliance with Section ~~150~~150.0(k), the ballasts shall be certified to the Commission to comply with the applicable requirements in Section 110.9(+) and
- E. Allow ballast maintenance and replacement to be readily accessible to building occupants from below the ceiling without requiring the cutting of holes in the ceiling.

439. Residential Outdoor Lighting. Luminaires providing residential outdoor lighting shall meet the following requirements, as applicable; including outdoor lighting for private patios on low-rise residential buildings with four or more dwelling units, entrances, balconies, and porches, and which are permanently mounted to a residential building or to other buildings on the same lot shall be high efficacy luminaires.

A. For low-rise, single-family residential buildings, outdoor lighting permanently mounted to a residential building or other buildings on the same lot shall be high efficacy, or may be low efficacy if it **EXCEPTION 1 to Section 150(k)134:** Permanently installed outdoor low efficacy luminaires shall meet all of the following requirements:

i. be allowed provided that they are ~~e~~Controlled by a manual ~~on/off~~ON and OFF switch; and

ii. ~~Controlled by~~ a motion sensor not having an override or bypass switch that disables the motion sensor, or controlled by a motion sensor having a temporary override switch which temporarily bypasses the motion sensing function and automatically reactivates the motion sensor within 6 hours; and

iii. ~~Controlled by~~ one of the following methods:

aA. Photocontrol not having an override or bypass switch that disables the photocontrol; or

bB. Astronomical time clock not having an override or bypass switch that disables the astronomical time clock, and which is programmed to automatically turn the outdoor lighting OFF during daylight hours; or

cC. Energy management control system (EMCS) which meets all of the following requirements: At a minimum provides the functionality of an astronomical time clock in accordance with Section 110.9; meets the acceptance test requirements in Section 130.4; meets the requirements for an EMCS in Section 130.5; ~~does not have~~ing an override or bypass switch that allows the luminaire to be always ~~on~~ON; and, is programmed to automatically turn the outdoor lighting OFF during daylight hours.

~~**EXCEPTION 2 to Section 150(k)13:** Outdoor luminaires used to comply with Exception 1 to Section 150(k)13 may be controlled by a temporary override switch which bypasses the motion sensing function provided that the motion sensor is automatically reactivated within 6 hours.~~

B. For low-rise multi-family residential buildings, outdoor lighting for private patios, entrances, balconies, and porches; and outdoor lighting for residential parking lots and residential carports with less than eight vehicles per site shall comply with one of the following requirements:

i. Shall comply with Section 150.0(k)9A; or

ii. Shall comply with the applicable requirements in Sections 110.9, 130.0, 130.2, 130.4, 140.7, and 141.0.

C. For low-rise residential buildings with four or more dwelling units, outdoor lighting not regulated by Section 150.0(k)9B or Section 150.0(k)9D shall comply with the applicable requirements in Sections 110.9, 130.0, 130.2, 130.4, 140.7, and 141.0.

~~**EXCEPTION 3 to Section 150(k)13:** Permanently installed luminaires in or around swimming pools, water features, or other locations subject to Article 680 of the California Electric Code need not be high efficacy luminaires.~~

D. Outdoor lighting for residential parking lots and residential carports with a total of eight or more vehicles per site shall comply with the applicable requirements in Sections 110.9, 130.2, 130.4, 140.7, and 141.0.

~~445~~10. **Internally illuminated address signs.** Internally illuminated address signs shall:

- A. Comply with Section 140.8; or
- B. ~~Shall Not contain a screw base socket, and~~ consume no more than 5 watts of power as determined according to Section 130.0(~~dc~~).

~~456~~11. **Parking Lots and Residential Garages for Eight or More Vehicles.** ~~Lighting for parking lots and carports with a total of eight or more vehicles per site shall comply with the applicable requirements in Sections 130, 132, 134, and 147. Lighting for residential parking garages for eight or more vehicles shall comply with the applicable requirements for nonresidential garages in Sections 110.9, 130.0, 130.1, 130.4, and 140.6, and 141.0.~~

~~467~~12. **Interior Common Areas of Low-rise Multi-Family Residential Buildings.** ~~Permanently installed lighting in the enclosed, non-dwelling spaces of low-rise residential buildings with four or more dwelling units shall be high efficacy luminaires.~~

~~**EXCEPTION to Section 150(k)167:** Permanently installed low efficacy luminaires shall be allowed provided that they are controlled by an occupant sensor(s) certified to comply with the applicable requirements of Section 119. A. In a low-rise multi-family residential building where the total interior common area in a single building equals 20 percent or less of the floor area, permanently installed lighting for the interior common areas in that building shall be high efficacy luminaires or controlled by an occupant sensor.~~

~~B. In a low-rise multi-family residential building where the total interior common area in a single building equals more than 20 percent of the floor area, permanently installed lighting in that building shall:~~

- ~~i. Comply with the applicable requirements in Sections 110.9, 130.0, 130.1, 140.6, and 141.0; and~~
- ~~ii. Lighting installed in corridors and stairwells shall be controlled by occupant sensors that reduce the lighting power in each space by at least 50 percent. The occupant sensors shall be capable of turning the light fully on from all designed paths of egress.~~

(l) **Slab Edge Insulation.** Material used for slab edge insulation shall meet the following minimum specifications:

1. Water absorption rate for the insulation material alone without facings no greater than 0.3 percent when tested in accordance with Test Method A – 24-Hour-Immersion of ASTM C272.
2. Water vapor permeance no greater than 2.0 perm/inch when tested in accordance with ASTM E96.
3. Concrete slab perimeter insulation shall be protected from physical damage and ultraviolet light deterioration.
4. Insulation for a heated slab floor shall meet the requirements of Section 110.8(g).

(m) **Air-Distribution and Ventilation System Ducts, Plenums, and Fans.**

1. **CMC eCompliance.** All air-distribution system ducts and plenums, including, but not limited to, mechanical closets and air-handler boxes, shall be installed, sealed and insulated to meet the requirements of the CMC Sections 601, 602, 603, 604, 605 and ANSI/SMACNA-006-2006 HVAC Duct Construction Standards Metal and Flexible 3rd Edition Standard 6-5, incorporated herein by reference. Portions of supply-air and return-air ducts and plenums of a space heating or cooling system shall either be insulated to a minimum installed level of R-4-26.0 (or any higher level required by CMC Section 605) or be enclosed entirely in directly conditioned space as confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix Section RA3.1.4.3.8. Connections of metal ducts and the inner core of flexible ducts shall

be mechanically fastened. Openings shall be sealed with mastic, tape, or other duct-closure system that meets the applicable requirements of UL 181, UL 181A or UL 181B or aerosol sealant that meets the requirements of UL 723. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used.

Building cavities, support platforms for air handlers, and plenums defined or constructed with materials other than sealed sheet metal, duct board or flexible duct shall not be used for conveying conditioned air. Building cavities and support platforms may contain ducts. Ducts installed in cavities and support platforms shall not be compressed to cause reductions in the cross-sectional area of the ducts.

EXCEPTION to Section 150150.0(m)1: The requirements do not apply to ducts and fans integral to a wood heater or fireplace.

2. **Factory-fabricated Duct Systems.**

- A. All factory-fabricated duct systems shall comply with UL 181 for ducts and closure systems, including collars, connections, and splices, and be labeled as complying with UL 181. UL 181 testing may be performed by UL laboratories or a laboratory approved by the Executive Director.
- B. All pressure-sensitive tapes, heat-activated tapes, and mastics used in the manufacture of rigid fiberglass ducts shall comply with UL 181 and UL 181A.
- C. All pressure-sensitive tapes and mastics used with flexible ducts shall comply with UL 181 and UL 181B.
- D. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.

3. **Field-fabricated Duct Systems.**

- A. Factory-made rigid fiberglass and flexible ducts for field-fabricated duct systems shall comply with UL 181. All pressure-sensitive tapes, mastics, aerosol sealants, or other closure systems used for installing field-fabricated duct systems shall meet the applicable requirements of UL 181, UL 181A, and UL 181B.
- B. Mastic sealants and mesh.
 - i. Sealants shall comply with the applicable requirements of UL 181, UL 181A, and UL 181B, and be nontoxic and water resistant.
 - ii. Sealants for interior applications shall be tested in accordance with ASTM C731 and D2202, incorporated herein by reference.
 - iii. Sealants for exterior applications shall be tested in accordance with ASTM C731, C732, and D2202, incorporated herein by reference.
 - iv. Sealants and meshes shall be rated for exterior use.
- C. Pressure-sensitive tape. Pressure-sensitive tapes shall comply with the applicable requirements of UL 181, UL 181A, and UL 181B.
- D. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.
- E. Drawbands used with flexible duct.
 - i. Drawbands shall be either stainless-steel worm-drive hose clamps or UV-resistant nylon duct ties.
 - ii. Drawbands shall have a minimum tensile strength rating of 150 pounds.
 - iii. Drawbands shall be tightened as recommended by the manufacturer with an adjustable tensioning tool.
- F. Aerosol-sealant closures.
 - i. Aerosol sealants shall meet the requirements of UL 723 and be applied according to manufacturer specifications.
 - ii. Tapes or mastics used in combination with aerosol sealing shall meet the requirements of this section.

4. **Duct Insulation R-value Ratings.** All duct insulation product R-values shall be based on insulation only (excluding air films, vapor ~~barriers~~retarder, or other duct components) and tested C-values at 75°F mean temperature at the installed thickness, in accordance with ASTM C518 or ASTM C177, incorporated herein by reference, and certified pursuant to Section 110.8.
5. **Duct Insulation Thickness.** The installed thickness of duct insulation used to determine its R-value shall be determined as follows:
 - A. For duct board, duct liner, and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
 - B. For duct wrap, installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
 - C. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.
6. **Duct Labeling.** Insulated flexible duct products installed to meet this requirement shall include labels, in maximum intervals of 3 feet, showing the thermal performance R-value for the duct insulation itself (excluding air films, vapor ~~barriers~~retarder, or other duct components), based on the tests in Section ~~150150.0~~(m)4 and the installed thickness determined by Section ~~150150.0~~(m)5C.
7. **Backdraft Dampers.** All fan systems, regardless of volumetric capacity, that exhaust air from the building to the outside shall be provided with backdraft or automatic dampers to prevent air leakage.
8. **Gravity Ventilation Dampers.** All gravity ventilating systems that serve conditioned space shall be provided with either automatic or readily accessible, manually operated dampers in all openings to the outside except combustion inlet and outlet air openings and elevator shaft vents.
9. **Protection of Insulation.** Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind but not limited to the following: Insulation exposed to weather shall be suitable for outdoor service e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
10. **Porous Inner Core Flex Duct.** Flexible ducts having porous inner cores shall not be used.
11. **Duct System Leakage.** When space conditioning systems utilize forced air duct systems to supply conditioned air to an occupiable space, the ducts shall be sealed, as confirmed through field verification and diagnostic testing, in accordance with all applicable procedures specified in Reference Residential Appendix RA3.1 and leakage compliance criteria specified in Reference Residential Appendix Table RA3.1-2.
12. **Air Filtration.**

Mechanical systems that supply air to an occupiable space through ductwork exceeding 10 ft (3 m) in length and through a thermal conditioning component, except evaporative coolers, shall comply with the following:

 - A. **System Configuration.** The system shall be configured to ensure that all recirculated air and all outdoor air supplied to the occupiable space is filtered before passing through the system's thermal conditioning components. All system air filter devices shall be located and installed in such a manner as to facilitate access and regular service by the owner. All system air filter device locations shall be labeled to disclose the design airflow rate applicable to the air filter device and the maximum allowable clean-filter pressure drop. The labels shall conform to a format and durability requirement approved by the Commission, be readily legible, and shall be visible to a person replacing the air filter.
 - B. **Air Filter Efficiency.** The system shall be provided with air filters having a designated efficiency equal to or greater than MERV 6 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50% in the 3.0–10 µm range when tested in accordance with AHRI Standard 680.
 - C. **Air Filter Pressure Drop.** The system shall be designed to accommodate the clean-filter pressure drop, as rated using AHRI Standard 680, for the applicable design airflow rate(s) for the system air filter device(s). If

the exception to 150.0(m)13B is utilized for compliance, the design clean-filter pressure drop for the system air filter device(s) shall conform to the requirements given in Tables 150.0-C and 150.0-D;

D. **Air Filter Product Labeling.** All air filter products shall be labeled by the manufacturer to disclose the AHRI Standard 680 performance ratings for airflow rate, initial and final resistance (pressure drop), dust holding capacity, and the particle size efficiency for three particle size ranges: 0.30 µm to 1.0 µm, 1.0 µm to 3.0 µm, and 3.0 µm to 10 µm.

13. **Duct System Sizing and Air Filter Grille Sizing.** Space conditioning systems that utilize forced air ducts to supply cooling to an occupiable space shall:

A. Have a hole for the placement of a static pressure probe (HSPP), or a permanently installed static pressure probe (PSPP) in the supply plenum downstream of the air conditioning evaporator coil. The size, location, and labeling of the HSPP or PSPP shall conform to the requirements specified in Reference Residential Appendix RA3.3.1.1 as confirmed by field verification and diagnostic testing, and

B. Demonstrate, in every control mode, airflow greater than 350 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to 0.58 W/CFM as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.

EXCEPTION to 150.0(m)13B: Standard ducted systems (systems without zoning dampers) may comply by meeting the applicable requirements in Table 150.0-C or Table 150.0-D as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Sections RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 150(m)12C for the system air filter device(s) shall conform to the requirements given in Tables 150.0-C and 150.0-D

14. **HVAC System Bypass Ducts.** Bypass ducts that deliver conditioned supply air directly to the space conditioning system return duct airflow shall not be used.

15. **Zonally Controlled Central Forced Air System.** Central forced air systems shall simultaneously demonstrate, in every zonal control mode, an airflow from the dwelling, through the air handler fan and delivered to the dwelling greater than 350 CFM per ton of nominal cooling capacity, and an air-handling unit fan efficacy of less than 0.58 W/CFM as confirmed by field verification and diagnostic testing in accordance with the procedures specified in Reference Residential Appendix RA3.3.

(n) **Water Heating System.**

1. Systems using gas or propane water heaters to serve individual dwelling units shall include the following components:

A. A 120V electrical receptacle within 3 feet from the water heater. This electrical receptacle shall be accessible to the water heater with no obstructions; and

B. A Category III or IV vent, or a Type B vent with straight pipe between the outside termination and the space where the water heater is installed; and

C. A condensate drain that is no more than 2 inches higher than the base of the installed water heater, allows natural draining without pump assistance, and meets local jurisdiction requirements; and

D. A gas supply line with a capacity of at least 200,000 Btu/hr.

2. ~~Water Heating Recirculation Loops Serving Multiple Dwelling Units.~~ Water heating recirculation loops serving multiple dwelling units shall meet the requirements of Section 110.3(c)5.

3. Solar water-heating systems and/or collectors shall be certified and rated by the Solar Rating and Certification Corporation (SRCC) or by a testing agency approved by the Executive Director.

- (o) **Ventilation for Indoor Air Quality.** All dwelling units shall meet the requirements of ~~ANSI~~ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings. Window operation is not a permissible method of providing the Whole-Building Ventilation airflow required in Section 4 of ~~that~~ASHRAE Standard 62.2. Continuous operation of central forced air system air handlers used in central fan integrated ventilation systems is not a permissible method of providing the whole-building ventilation airflow required in Section 4 of ASHRAE Standard 62.2.

Additionally, all dwelling units shall meet the following requirements:

1. Field Verification and Diagnostic Testing.

- A. Airflow Performance.** The Whole-Building Ventilation airflow required by Section 4 of ASHRAE Standard 62.2 shall be confirmed through field verification and diagnostic testing in accordance with the procedures specified in Reference Residential Appendix RA3.7.

- (p) **Pool Systems and Equipment Installation.** Any residential pool system or equipment installed shall comply with the applicable requirements of Section 110.4, as well as the requirements listed in this section.

1. Pump sizing and flow rate.

- A. All pumps and pump motors installed shall be listed in the Commission's directory of certified equipment and shall comply with the Appliance Efficiency Regulations.
- B. All pump flow rates shall be calculated using the following system equation:

$$H = C \times F^2$$

WHERE:

H is the total system head in feet of water.

F is the flow rate in gallons per minute (gpm).

C is a coefficient based on the volume of the pool:

0.0167 for pools less than or equal to 17,000 gallons.

0.0082 for pools greater than 17,000 gallons.

and;

- C. Filtration pumps shall be sized, or if programmable, shall be programmed, so that the filtration flow rate is not greater than the rate needed to turn over the pool water volume in 6 hours or 36 gpm, whichever is greater; and
- D. Pump motors used for filtration with a capacity of 1 hp or more shall be multi-speed; and
- E. Each auxiliary pool load shall be served by either separate pumps or the system shall be served by a multi-speed pump; and
- EXCEPTION to Section 150150.0(p)1E:** Pumps if less than 1 hp may be single speed.
- F. Multi-speed pumps shall have controls which default to the filtration flow rate when no auxiliary pool loads are operating; and
- G. For multi-speed pumps, the controls shall default to the filtration flow rate setting within 24 hours and shall have an override capability for servicing.

2. System piping.

- A. A length of straight pipe that is greater than or equal to at least 4 pipe diameters shall be installed before the pump; and
- B. Pool piping shall be sized so that the velocity of the water at maximum flow for auxiliary pool loads does not exceed 8 feet per second in the return line and 6 feet per second in the suction line; and

- C. All elbows shall be sweep elbows or elbow-type that **have** a pressure drop of less than the pressure drop of straight pipe with a length of 30 pipe diameters.
- 3. **Filters.** Filters shall be at least the size specified in NSF/ANSI 50 for public pool intended applications.
- 4. **Valves.** Minimum diameter of backwash valves shall be 2 inches or the diameter of the return pipe, whichever is greater.

(g) Fenestration Products. Fenestration separating conditioned space from unconditioned space or outdoors shall meet the requirements of either Item 1 or 2 below:

- 1. Fenestration including skylight products must have a maximum U-factor of 0.58.
- 2. The weighted average U-factor of all fenestration including skylight products throughout the conditioned space of the building shall not exceed a 0.58 U-factor.

EXCEPTION to Section 150.0(g)1: Up to 10 square feet of fenestration area or 0.5% of the Conditioned Floor Area whichever is greater is exempt from the U-factor.

(r) Solar Ready. Buildings shall meet the requirements of Section 110.10 applicable to the building project.

TABLE 150-A PIPE INSULATION CONDUCTIVITY RANGE

FLUID TEMPERATURE RANGE (°F)	INSULATION MEAN RATING TEMPERATURE (°F)	CONDUCTIVITY RANGE (Btu-inch-per-hour per square foot per °F) [†]
201—250	150	0.27—0.30
105—201	100	0.24—0.28
Below 105	75	0.23—0.27

[†]Insulation conductivity shall be determined in accordance with ASTM C 335 at the mean temperature listed in TABLE 150-A, and shall be rounded to the nearest 1/100 Btu-inch-per-hour per square foot per °F.

TABLE 150-B PIPE INSULATION MINIMUM THICKNESS REQUIREMENTS

SYSTEM	PIPE DIAMETER	
	Less than or Equal to 2 inches	Greater than 2 inches
INSULATION THICKNESS REQUIRED (in inches)		
Domestic hot water (above 105°F)	1.0	1.5
Hydronic heating supply lines (above 200°F to 250°F) [†]	1.0	2.0
Hydronic heating supply lines (105°F to 200°F)	1.0	1.5
Cooling system refrigerant suction, chilled water and brine lines	0.75	1.0

[†]Steam hydronic heating systems or hot water systems with pressure above 15 psi shall meet the requirements of TABLE 120.3-A.

TABLE 150-C HIGH EFFICACY LUMINAIRE REQUIREMENTS

Lamp Power Rating for Non-LED Lighting (see Note 1), or System Power Rating for LED Lighting (see Notes 2, 3, and 4)	Minimum Lamp Efficacy for Non-LED Lighting, or Minimum System Efficacy for LED Lighting
5-watts or less	30 lumens per watt
over 5-watts to 15-watts	40 lumens per watt
over 15-watts to 40-watts	50 lumens per watt
over 40-watts	60 lumens per watt

Notes:

1. Determine minimum lamp efficacy category for lighting systems which are not LED using the initial rated lumens divided by the rated watts of the lamp (not including the ballast).
2. To qualify as high efficacy, an LED luminaire shall meet the minimum system efficacy requirements in Table 150-C when determined according to Reference Joint Appendix JA8, and be certified to comply with Section 119(m), and input power shall be determined according to Section 130(d)5.
3. For a Hybrid LED Luminaire to qualify as a high efficacy luminaire, all lighting systems in the luminaire shall qualify as high efficacy according to Section 150(k)1, and the LED Light Engine with Integral Heat Sink shall comply with Note 4, below.
4. To qualify as high efficacy, an LED Light Engine with Integral Heat Sink shall meet the minimum system efficacy requirements in Table 150-C when determined according to Reference Joint Appendix JA8, shall be certified to comply with Section 119(m), and input power shall be determined according to Section 130(d)5.

TABLE 150.0-CA CLASSIFICATION OF HIGH EFFICACY AND LOW EFFICACY LIGHT SOURCES

<u>High Efficacy Light Sources</u>	<u>Low Efficacy Light Sources</u>
<p><u>Luminaires manufactured, designed and rated for use with only lighting technologies in this column shall be classified as high efficacy:</u></p>	<p><u>Luminaires manufactured, designed or rated for use with any of the lighting technologies in this column shall be classified as low efficacy.</u></p>
<p><u>1. Pin-based fluorescent lamps.</u> <u>2. Pulse-start metal halide lamps.</u> <u>3. High pressure sodium lamps.</u> <u>4. GU-24 sockets rated for LED lamps.</u> <u>5. GU-24 sockets rated for compact fluorescent lamps, and which are not recessed luminaires.</u> <u>6. Luminaires using LED light sources which have been certified to the Commission as high efficacy in accordance with Reference Joint Appendix JA-8.</u> <u>7. Luminaire housings rated by the manufacturer for use with only LED light engines.</u> <u>8. Induction lamps.</u> <u>Note: Adaptors which convert an incandescent lamp holder to a high-efficacy luminaire shall not be used to classify a luminaire as high efficacy.</u></p>	<p><u>1. Line-voltage lamp holders (sockets) capable of operating incandescent lamps of any type.</u> <u>2. Low-voltage lamp holders capable of operating incandescent lamps of any type.</u> <u>3. High efficacy lamps installed in low-efficacy luminaires, including screw base compact fluorescent and screw base LED lamps.</u> <u>3. Mercury vapor lamps.</u> <u>4. Track lighting or other flexible lighting system which allows the addition or relocation of luminaires without altering the wiring of the system.</u> <u>6. Luminaires using LED light sources which have not been certified to the Commission as high efficacy.</u> <u>7. Lighting systems which have modular components that allow conversion between high-efficacy and low-efficacy lighting without changing the luminaires' housing or wiring.</u> <u>8. Electrical boxes finished with a blank cover or where no electrical equipment has been installed, and where the electrical box can be used for a luminaire or a surface mounted ceiling fan.</u></p>

TABLE 150.0-DB MINIMUM REQUIREMENTS FOR OTHER LIGHT SOURCES TO QUALIFY AS HIGH EFFICACY

Use this table to determine luminaire efficacy only for lighting systems not listed in Table 150.0-C	
Luminaire Power Rating	Minimum Luminaire Efficacy to Qualify as High Efficacy
<u>5 watts or less</u>	<u>30 lumens per watt</u>
<u>over 5 watts to 15 watts</u>	<u>45 lumens per watt</u>
<u>over 15 watts to 40 watts</u>	<u>60 lumens per watt</u>
<u>over 40 watts</u>	<u>90 lumens per watt</u>
<p><u>Note: Determine minimum luminaire efficacy using the system initial rated lumens divided by the luminaire total rated system input power.</u></p>	

Table 150.0-EC: Return Duct Sizing for Single Return Duct Systems

Return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees, one bend shall be a metal elbow.

Return grill devices shall be labeled in accordance with the requirements in section 150.0(m)12A to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of 12.5 Pa (0.05 inches water) as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.:

<u>System Nominal Cooling Capacity (Ton)*</u>	<u>Minimum Return Duct Diameter (inch)</u>	<u>Minimum Total Return Filter Grill Gross Area (inch²)</u>
<u>1.5</u>	<u>16</u>	<u>500</u>
<u>2.0</u>	<u>18</u>	<u>600</u>
<u>2.5</u>	<u>20</u>	<u>800</u>

*Not applicable to systems with nominal cooling capacity greater than 2.5 tons or less than 1.5 tons

Table 150.0-FD: Return Duct Sizing for Multiple Return Duct Systems

<p>Each return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees, one bend shall be a metal elbow.</p> <p>Return grill devices shall be labeled in accordance with the requirements in section 150.0(m)12A to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of 12.5 Pa (0.05 inches water) as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.</p>			
<u>System Nominal Cooling Capacity (Ton)*</u>	<u>Return Duct 1 Minimum Diameter (inch)</u>	<u>Return Duct 2 Minimum Diameter (inch)</u>	<u>Minimum Total Return Filter Grill Gross Area (inch²)</u>
<u>1.5</u>	<u>12</u>	<u>10</u>	<u>500</u>
<u>2.0</u>	<u>14</u>	<u>12</u>	<u>600</u>
<u>2.5</u>	<u>14</u>	<u>14</u>	<u>800</u>
<u>3.0</u>	<u>16</u>	<u>14</u>	<u>900</u>
<u>3.5</u>	<u>16</u>	<u>16</u>	<u>1000</u>
<u>4.0</u>	<u>18</u>	<u>18</u>	<u>1200</u>
<u>5.0</u>	<u>20</u>	<u>20</u>	<u>1500</u>
<p><u>*Not applicable to systems with nominal cooling capacity greater than 5.0 tons or less than 1.5 tons.</u></p>			

151150.1 Residential General Performance and Prescriptive

SUBCHAPTER 8

LOW-RISE RESIDENTIAL BUILDINGS—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR NEWLY CONSTRUCTED BUILDINGS

SECTION 151150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR NEWLY CONSTRUCTED BUILDINGS

(a) **Basic Requirements.** New low-rise residential buildings shall meet all of the following:

1. The requirements of Sections 110.1 through 110.9-10 are applicable to new residential buildings.
2. The requirements of Section 150.0 (mandatory features).
3. Either the performance standards (energy budgets) or the prescriptive standards (alternative component packages) set forth in this section for the climate zone in which the building will be located. Climate zones are shown in Reference Joint Appendix JA2 –Weather /Climate Data FIGURE 101-A.

ALTERNATIVE EXCEPTION to Section 151150.1(a)3: If a single contiguous subdivision or tract falls in more than one climate zone, all buildings in the subdivision or tract may be designed to meet the performance or prescriptive standards for the climate zone that contains 50 percent or more of the dwelling units.

NOTE: The Commission periodically updates, publishes, and makes available to interested persons and local enforcement agencies precise descriptions of the ~~metes and bounds for~~ climate zones, which is available by zip codes boundaries depicted in Reference Joint Appendix JA2 –Weather-/Climate Data FIGURE 101-A and a list of the communities in each zone.

4. For other provisions applicable to new low-rise residential buildings, refer to Section 100.0.

(b) **Performance Standards.** A building complies with the performance standard if the energy budget calculated for the Proposed Design Building under Subsection 2 is no greater than the energy budget calculated for the Standard Design Building under Subsection 1. the combined depletable TDV energy use for water heating Section 151(b)1 and space conditioning Section 151(b)2 is less than or equal to the combined maximum allowable TDV energy use for both water heating and space conditioning, even if the building fails to meet either the water heating or space conditioning budget alone.

1. **Energy Budget for the Standard Design Building.** The energy budget for a Standard Design Building is determined by applying the mandatory and prescriptive requirements to the Proposed Design Building. The energy budget is the sum of the TDV energy for space-conditioning, lighting, mechanical ventilation and water heating.
2. **Energy Budget for the Proposed Design Building.** The energy budget for a Proposed Design Building is determined by calculating the TDV energy for the Proposed Design Building. The energy budget is the sum of the TDV energy for space-conditioning, lighting, mechanical ventilation and water heating.
3. **Calculation of Energy Budget.** The TDV energy for both the Standard Design Building and the Proposed Design Building shall be computed by Compliance Software certified for this use by the Commission. The processes for Compliance Software approval are documented in the Residential ACM Approval Manual.
4. **Water heating budgets.** The water heating budgets for each climate zone shall be the calculated consumption of energy from depletable sources required for water heating in buildings in which the requirements of Section

151(a) and of Section 151(f)8A for systems serving individual dwelling units or of Section 151(f)8C for systems serving multiple dwelling units are met. To determine the water heating budget, use an approved calculation method.

2. ~~**Space conditioning budgets.**~~ The space conditioning budgets for each climate zone shall be the calculated consumption of energy from depletable sources required for space conditioning in buildings in which the basic requirements of Section 151(a) and the measures in Section 151(f) applicable to Alternative Component Package D are installed. To determine the space conditioning budget, use an approved calculation method.
3. ~~**Multiple heating systems.**~~ If a space or a zone is served by more than one heating system, compliance shall be demonstrated with the most TDV energy consuming system serving the space or the zone. For spaces or zones that are served by electric resistance heat in addition to other heating systems, the electric resistance heat shall be deemed to be the most TDV energy consuming system.

~~**EXCEPTION to Section 151(b)3:**~~ A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kW or 7,000 Btu/hr and is controlled by a time limiting device not exceeding 30 minutes.

~~**(e) Compliance Demonstration Requirements for Performance Standards.**~~ The application for a building permit shall include documentation which demonstrates, using an approved calculation method, that the newly constructed building has been designed so that its TDV energy use from depletable energy sources does not exceed the combined water heating and space conditioning energy budgets for the appropriate climate zone.

1. ~~To demonstrate compliance, the applicant's documentation shall:~~

A. ~~Determine the combined energy budget for the proposed building by adding the following:~~

- i. ~~The annual water heating budget (TDV kBtu/yr ft²) as determined pursuant to Section 151(b)1; and~~
- ii. ~~The annual space conditioning budget (TDV kBtu/yr ft²) as determined pursuant to Section 151(b)2.~~

B. ~~Calculate the TDV energy consumption total of the proposed building, using the proposed building's actual glazing area, orientation, and distribution, and its actual energy conservation and other features, including the actual water heating, space conditioning equipment and duct conditions and locations.~~

~~Include in the calculation the energy required for building cooling even if the building plans do not indicate that air conditioning will be installed.~~

2. ~~The proposed building design complies if the energy consumption calculated pursuant to Section 151(e)1B is equal to or less than the combined energy budget established in Section 151(e)1A.~~

~~**MULTIPLE ORIENTATION ALTERNATIVE to Section 151(e):**~~ A permit applicant may demonstrate compliance with the energy budget requirements of Section 151(a) and (b) for any orientation of the same building model if the documentation demonstrates that the building model with its proposed designs and features would comply in each of the four cardinal orientations.

~~**(d) Compliance Methods for Performance Standards.**~~ Compliance with the energy budget requirements of Section 151(b) must be demonstrated by using the compliance version of the Commission's Public Domain Computer Program or any alternative calculation method approved by the Commission for use in complying with Sections 151(a), 151(b), 151(c), and 151(e).

~~**(e) Required Performance Calculation Assumptions.**~~ The Commission shall publish the assumptions and calculation methods it used to develop the standards for low-rise residential buildings, including those specified in Section 151. In determining the water heating and space conditioning budgets and calculating the energy use of the proposed building design, the applicant shall use only these assumptions and calculation methods, or alternative assumptions and methods approved by the Commission.

1. ~~Such assumptions shall include, but not be limited to, the following:~~

A. ~~The operating conditions regarding indoor temperature; occupancy loads and schedules; equipment loads and operation schedules, including lighting, HVAC, and miscellaneous electrical; and outdoor weather conditions.~~

- ~~B. The physical characteristics of building pressurization, interior heat transfer, film coefficients, solar heat gain coefficient and operation of installed shading devices, ground temperatures, and the method of determining slab heat loss.~~
- ~~C. The applicable modeling procedures for the assumptions, design conditions, and physical characteristics described in Section 151(e)1.~~
- ~~D. Water heating use schedules, cold water inlet temperatures, and average outdoor temperatures for calculating water heating loads and losses.~~

~~**EXCEPTION to Section 151(e)1:** The Commission may approve alternative schedules, assumptions, and performance modeling procedures that may be used in lieu of those described in Section 151(e)1, provided such alternatives do not alter the efficiency level required by these standards.~~

- ~~2. The total calculated annual energy consumption shall include all energy used for comfort heating, comfort cooling, ventilation for the health and comfort of occupants, and service water heating.~~
- ~~3. Heat transfers within the same building to adjacent spaces that are not covered by the permit and that are independently provided with space conditioning may be considered to be zero. Heat transfers to spaces not yet provided with space conditioning may be modeled as separate unconditioned zones, or as outdoor conditions.~~
- ~~4. The total calculated annual energy consumption need not include energy from any nondepletable sources, regardless of the purpose of the energy consumed.~~
- ~~5. Solar heat gain coefficients for interior shading devices used with fenestration products shall be 0.68 for vertical fenestration products and 1.0 for non-vertical fenestration products. No other solar heat gain coefficients shall be used for interior shading. The calculations for vertical fenestration products include the effects of draperies and insect screens without installation being verified at the time of final inspection.~~

~~(c) **Prescriptive Standards/-Component Packages.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements of one of the packages of components shown in TABLE 151 B, TABLE 151 C, or TABLE 151 D for the appropriate climate zone shown in TABLE 150.1-A, FIGURE 401-A. In TABLE 151 B, 151 C, AND TABLE 151 D, TABLE 150.1-A, a NA (not allowed) means that feature is not allowed-permitted in a particular climate zone and a NR (no requirement) means that there is no prescriptive requirement for that feature in a particular climate zone. Installed components shall meet the following requirements:~~

~~1. Insulation.~~

- ~~A. Ceiling insulation requirements include the components of attic ceiling and above deck, or below deck insulation, and rafter roofs. — Ceiling and, roof deck, wall, slab floor perimeter, and raised floor insulation shall be installed with which have an R-value equal to or higher-greater than or U-factor equal to or less than that shown in TABLE 151 B, TABLE 151 C, or TABLE 151 D. TABLE 150.1-A shall be installed. - The minimum opaque ceiling, minimum opaque attic ceiling and below deck R-values or U-factors shown are for insulation installed between wood-framing members. wall (including heated basements and crawl spaces), and raised floor R-values shown are for insulation installed between wood-framing members. The minimum opaque above deck R-values or U-factors shown are for continuous insulation installed above a wood-framed roof deck.~~

~~**EXCEPTION ALTERNATIVE 1 to Section 151150.1(f)1A:** The insulation requirements of TABLE 151 B, TABLE 151 C, or TABLE 151 D may also be met by ceiling, roof deck, wall, or floor assemblies that meet equivalent minimum R-values that consider the effects of all elements of the assembly, using a calculation method approved by the Executive Director.~~

- ~~**EXCEPTION 2 to Section 151150.1(f)1A:** Raised floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in TABLE 151 B, TABLE 151 C, or TABLE 151 D, a vapor barrier is placed over the entire floor of the crawl space, and the vents are fitted with automatically operated louvers. B. Wall, slab floor perimeter, and raised-floor insulation which have an R-value equal to or higher or U-factor equal to or less than that shown in TABLE 150.1-A shall be installed. The minimum~~

opaque wall (including heated basements and crawl spaces), and raised-floor R-values or U-factors shown are for insulation installed between wood-framing members.

EXCEPTION 1 to Section 150.1(c)1A and B: The insulation requirements of TABLE 150.1-A may also be met by ceiling, roof deck, wall, or floor assemblies that meet equivalent minimum R-values or maximum U-factors that consider the effects of all elements of the assembly, using a calculation method approved by the Executive Director.

EXCEPTION 2 to Section 150.1(c)1B: Raised-floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in TABLE 150.1-A, and a vapor retarder is placed over the entire floor of the crawl space, and the vents are fitted with automatically operated louvers, and the requirements of Reference Residential Appendix RA 4.5.1 are met.

BC. The minimum depth of concrete-slab floor perimeter insulation shall be 16 inches or the depth of the footing of the building, whichever is less.

~~EXCEPTION to Section 151(f)1B: Perimeter insulation is not required along the slab edge between conditioned space and the concrete slab of an attached unconditioned enclosed space, covered porches, or covered patios.~~

CD. Quality Insulation Installation shall meet Table 150.1-A, all requirements of the Quality Insulation Installation procedure of Reference Residential Appendices, RA3.5 shall be met.

2.— **Radiant Barrier.** A radiant barrier required in ~~TABLE 151-B, TABLE 151-C, or TABLE 151-D~~ TABLE 150.1-A shall ~~have an emittance of 0.05 or less, tested in accordance with ASTM C1371 or ASTM E408, shall be certified to the Department of Consumer Affairs as required by Title 24, Part 12, Chapter 12-13, Standards for Insulating Material, meet the requirements specified in Section 110.8(j),~~ and shall meet the installation criteria specified in the Reference Residential Appendix RA4.

EXCEPTION to Section 150.1(c)2: Radiant Barrier installation is not required when the roof deck insulation is installed below the roof deck.

3.— **Fenestration.**

A. Installed ~~vertical~~ fenestration products shall have an area-weighted average U-factor and SHGC no greater than the applicable value in equal to or lower than those shown in ~~TABLE 151-B, TABLE 151-C, or TABLE 151-D~~ TABLE 150.1-A and shall be determined in accordance with Section 110.6(a)2 and 110.6(a)3~~.~~

~~The U factor of installed fenestration products shall be determined in accordance with Section 116.~~

EXCEPTION 1 to Section ~~151~~150.1(c)3A: For each ~~building dwelling unit~~, up to an additional 3 square feet of the glazing installed in doors and up to an additional 23 square foot of tubular skylights with dual-pane diffusers ~~shall not be required to meet the total fenestration area and west-facing fenestration area requirements of Sections 150.1(c)3B and C~~

EXCEPTION 2 to Section 150.1(c)3A: For each ~~building dwelling unit~~ up to 108 square feet of skylight with a maximum U-factor of 0.55 and a maximum of SHGC 0.30, shall not be required to meet the total fenestration area and west-facing fenestration area requirements of Sections 150.1(c)3B and C.

EXCEPTION 3 to Section 150.1(c)3A: For Fenestration containing dynamic glazing, the lowest-rated labeled U-factor and SGHC shall be used to demonstrate compliance with this section. Dynamic glazing shall be considered separately from other fenestration and area-weighted averaging with other fenestration that is not dynamic shall not be permitted and shall be determined in accordance with Section 110.6(a).

EXCEPTION 4 to Section 150.1(c)3A: For dwelling units containing unrated site-built fenestration only and meeting the maximum area restriction, the U-factor and SHGC shall be determined in accordance with the Nonresidential Reference Appendix NA6.

- ~~B. The allowed total fenestration area shall not exceed the mMaximum (Total) fenestration aArea shall not exceed the percentage of Fenestration times the Cconditioned Ffloor Aarea~~
- ~~B. Total fenestration area shall not exceed the Floor Area, CFA, as, as indicated in TABLE 151-B, TABLE 151-C, or TABLE 151-D TABLE 150.1-A. Total fenestration includes skylights and west-facing glazing.~~
- ~~C. The maximum west-facing fenestration area shall not exceed the percentage of conditioned floor area as indicated in TABLE 150.1-A. West-facing fenestration area includes skylights tilted in any direction when the pitch is less than 1:12.~~

~~For Package D, (The west-facing fenestration area shall not exceed the percentage of conditioned floor area specified in TABLE 151-B, TABLE 151-C, OR TABLE 151-D. West-facing fenestration area includes skylights tilted to the west or tilted in any direction when the pitch is less than 1:12.~~

4. **Shading.** Where ~~TABLE 151-B, TABLE 151-C, or TABLE 151-D~~ TABLE 150.1-A requires a Maximum Ssolar hHeat Ggain Ccoefficient (SHGC), the requirements shall be met by ~~either one of the following:~~
 - A. ~~Complying with the required SHGC pursuant to Section 150.1(c)3A~~ Installing fenestration products, except for skylights, that have an area-weighted average SHGC equal to or lower than those shown in TABLE 151-B, TABLE 151-C, or TABLE 151-D TABLE 150.1-A. Skylights shall have an SHGC equal to or lower than those shown in TABLE 151-B, TABLE 151-C, or TABLE 151-D TABLE 150.1-A. The solar heat gain coefficient of installed fenestration products shall be determined in accordance with Section 116; or
 - B. An exterior operable shading louver or other exterior shading device that meets the required SHGC; or solar heat gain coefficient; or
 - C. A combination of Items A and B exterior shading device and fenestration product to achieve the same performance as achieved in ~~Item A~~ Section 150.1(c)3A.
 - D. For south-facing glazing only, by optimal overhangs shall be installed so that the south-facing glazing is fully shaded at solar noon on August 21 and substantially exposed to direct sunlight at solar noon on December 21.

EXCEPTION to Section 150.1(c)4D: Dynamic Glazing.

- E. ~~Exterior shading devices must be permanently secured with permanently attached attachments or fasteners that are not intended for removal. d~~

EXCEPTION to Section 150.1(c)4E: ~~Except Wwhere the California Building Code (CBC) requires emergency egress or is in conflict with Health and Safety regulations,;~~

~~exterior shading devices must be permanently attached to the outside of the structure with fasteners that require additional tools to remove (as opposed to clips, hooks, latches, snaps, or ties).~~

~~eSHGC30~~

5. ~~RESERVED~~ **Thermal mass.** Thermal mass required for Package C in TABLE 151-B shall meet or exceed the minimum interior mass capacity specified in TABLE 151-A.

~~The mass requirements in TABLE 151-A may be met by calculating the combined interior mass capacity of the mass materials using EQUATION 151-A.~~

EQUATION 151-A — CALCULATION OF INTERIOR MASS CAPACITY

$$IMC = [(A_1 \times UIMC_1) + (A_2 \times UIMC_2) + \dots + (A_n \times UIMC_n)]$$

WHERE:

A_n	=	Area of mass material, n.
$UIMC_n$	=	Unit interior mass capacity of mass material, n.

NOTE: The Commission's Residential Compliance Manual lists the unit interior mass capacity (UIMC) of various mass materials.

6. **Heating System Type.** Heating system types shall be installed as required in ~~TABLE 151-B~~ ~~TABLE 151-C~~ or ~~TABLE 151-D~~ Table 150.1-A. A gas-heating system is a natural or liquefied petroleum gas-heating system.
7. **Space Heating and Space Cooling.** All space heating and space cooling equipment shall comply with minimum Appliance Efficiency Regulations as specified in Sections 110.0 through 110.2 and meet ~~the all~~ applicable requirements of ~~subsections A and B~~ Sections 150.0, and 150.1(c)7. If the installed system requires an efficiency that exceeds the minimum, the system efficiency shall be confirmed through field verification and diagnostic testing according to the Matched Equipment Procedure specified in Reference Residential Appendix RA3.4.4.

Additionally, all systems shall comply with the following requirements, as applicable:

- A. When refrigerant charge measurement or charge indicator display is shown as required by ~~TABLE 151-B~~, ~~TABLE 151-C~~ or ~~TABLE 151-D~~ Table 150.1-A, ducted split system central air-cooled air conditioners and ducted split system air-source heat pumps shall:
- i. Have temperature measurement access holes (TMAH) installed according to the specifications in Reference Residential Appendix RA3.2.2.2.2 as verified by field verification and diagnostic testing; saturation temperature measurement sensors (STMS); and proper refrigerant charge confirmed through field verification and diagnostic testing in accordance with applicable procedures set forth in the Reference Residential Appendix Sections RA3.2.1 and RA3.2.2, or Reference Residential Appendix RA1; or
 - ii. Be equipped with a charge indicator display (CID) device that provides a clearly visible to the occupant. The display indication that shall demands attention when the air conditioner fails to meet the required system operating requirements parameters contained specified in the applicable section of Reference Joint Appendix JA6.2 for the installed CID technology. The CID display shall be provide indication that is constantly visible and within one foot of the air conditioner's thermostat. Systems equipped with a CID installations shall meet the requirements of Residential Field Verification and Diagnostic Test Procedures be confirmed by field verification and diagnostic testing utilizing the procedures specified in of Reference Residential Appendix RA3.4.2 and the specifications of Reference Joint Appendix JA6.
- B. For systems other than ducted split system central air conditioners and ducted split system heat pumps, when refrigerant charge measurement or charge indicator display is shown as required by Table 150.1-A, and when a space conditioning system is an air-cooled air conditioner or air-source heat pump that cannot meet the requirements of 150.1(c)7Ai or 150.1(c)7Aii, the space conditioning system installer shall submit Certificate of Installation documentation that certifies the system has the correct refrigerant charge as determined in accordance with the weigh-in charging method specified in Reference Residential Appendix RA3.2.3. HERS Rater field verification and diagnostic testing of the refrigerant charge for these systems shall not be required. The installation shall be inspected by a certified HERS Rater to verify the system identification information shown on the Certificate of Installation.

Additionally, these space conditioning systems shall conform to one of the following:

- i. For building permit applications dated prior to January 15, 2015 the system shall have a SEER equal to or greater than 14 and have an EER equal to or greater than 11. For building permit applications dated on or after January 15, 2015 the SEER shall be equal to or greater than 15 and the EER shall be equal to or greater than 12 ; or
- ii. The space conditioning system shall be a non-ducted system.

Exception to 150.1(c)7B: Packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have the weigh-in charging method performed at installation. The installer of these packaged systems shall submit Certificate of Installation documentation that

certifies the system is a packaged system for which the correct refrigerant charge has been verified by the system manufacturer prior to shipment from the factory. The installation shall be inspected by a certified HERS Rater to verify the system identification information shown on the Certificate of Installation.

~~B. When airflow and fan watt draw is shown as required by TABLE 151-B, TABLE 151-C or TABLE 151-D, ducted split system central air conditioners and ducted split system heat pumps shall:~~

~~i. Central forced air system fans shall simultaneously demonstrate, in every zonal control mode, an airflow greater than 350 CFM/ton of nominal cooling capacity and a fan watt draw less than 0.58 W/CFM as specified in Reference Residential Appendix RA3; and~~

~~ii. Have a hole for the placement of a static pressure probe (HSPP) or a permanently installed static pressure probe (PSPP) in the supply plenum downstream of the air conditioning evaporator coil. The size, location, and labeling shall meet the requirements specified in Reference Residential Appendix RA3.3.~~

8. ~~Domestic Water-heating Heating S~~ystems. Water-heating systems shall meet the requirements of either A, B, or C, ~~or D and meet the requirements of D and E and F or shall meet the requirements of Section 151-150.1(b)1.~~

A. For systems serving individual dwelling units, a single gas or propane storage type water heater with an input of 75,000 Btu per hour or less and no recirculation pumps, and that meets the tank insulation requirements of Section 150.0(j) and the requirements of Sections 110.1 and 110.3 shall be installed.

B. For systems serving individual dwelling units, a single gas or propane ~~instantaneous tankless~~ water heater with an input of 200,000 Btu per hour or less and no recirculation pumps or storage tank, and that meets the requirements of Sections 110.1 and 110.3 shall be installed.

C. For systems serving multiple dwelling units, a central water-heating system that ~~has~~includes the following components shall be installed:

~~i. Gas or propane water heaters, boilers or other water heating equipment that meet the minimum efficiency requirements of Sections 110.1 and 110.3; and~~

~~ii. A water heating recirculation loop that meets the requirements of Section 110.3(c)2 and Section 110.3(c)5 shall be installed and is equipped with an automatic control system that controls the recirculation pump operation based on measurement of hot water demand and hot water return temperature and has two recirculation loops each serving half of the building; and~~

EXCEPTION to Section 151(f)8Cii: Buildings with eight or fewer dwelling units are exempt from the requirement for two recirculation loops.

~~iii. A solar water-heating system meeting the installation criteria specified in Reference Residential Appendix RA4 and with a minimum solar savings fraction of 0.20 in climate zones 1 through 9 or a minimum solar savings fraction of 0.35 in climate zones 10 through 16. The solar savings fraction shall be determined using a calculation method approved by the Commission.~~

~~D. For systems serving individual dwelling units, an electric-resistance water heater may be installed as the main water heating source only if natural gas is unavailable, the water heater is located within the building envelope, and a 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 is installed. The solar savings fraction shall be determined using a calculation method approved by the Commission.~~

~~E. All hot water pipes from the heating source to the kitchen fixtures shall be thermally insulated as specified by Section 150(j)2.~~

~~EE. All buried hot water piping shall be insulated to meet the requirements of Section 150(j)2 and be installed in a waterproof and non-crushable casing or sleeve that allows for installation, removal and replacement of the enclosed water piping. The internal cross-section or diameter of the casing or sleeve shall be large enough to allow for insulation of the hot water piping.~~

~~9. **Thermostats.** Heating systems shall be equipped with thermostats that meet the setback thermostat requirements of Section 110.2(e). The exception 1 to Section 112 (e) shall not apply to any heating system installed in conjunction with TABLE 151-B, TABLE 151-C or TABLE 151-D.~~

~~109. **Space conditioning ducts.** All ducts shall either be in directly conditioned space as confirmed by field verification and diagnostic testing in accordance with Reference Residential Appendix RA3.1.4.3.8 or be insulated to a minimum installed level as specified by Table 150.1-A, TABLE 151-B, TABLE 151-C or TABLE 151-D and All ducts shall meet the all applicable minimum mandatory requirements of Section 150.0(m).~~

~~When duct sealing is shown as required by TABLE 151-B, TABLE 151-C or TABLE 151-D duct systems shall be sealed, as confirmed through field verification and diagnostic testing, in accordance with procedures specified in the Reference Residential Appendix RA3.~~

NOTE: Requirements for ~~duct sealing and~~ duct insulation in ~~Table Tables 151-B, 151-C, 150.1-A, and 151-D~~ do not apply to buildings with space conditioning systems that ~~have no do not have~~ ducts.

~~110. **Central Fan Integrated Ventilation Systems.** Central forced air system fans used in central fan integrated ventilation systems shall demonstrate, in Air Distribution Mode, an air-handling unit fan efficacy watt draw less than or equal to 0.58 W/CFM; as confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix RA3.3.~~

~~111. **Roofing products.** All roofing products shall meet the requirements of Section 110.8 and the applicable requirements of subsection A or B:~~

~~A. ~~In~~ Low-rise residential buildings with steep-sloped roofs:~~

~~i. For roofing products with a density of less than 5 pounds per square foot, in climate zones 10 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.~~

~~ii. For roofing products with a density of 5 pounds per square foot or more, in climate zones 1-10 through 15-16 shall have a minimum aged solar reflectance of 0.15-20 and a minimum thermal emittance of 0.85-75, or a minimum SRI of 16-10.~~

~~B. Low-rise residential buildings with low-sloped roofs, in climate zones 13 and 15 shall have a minimum aged solar reflectance of 0.55-65 and a minimum thermal emittance of 0.75; or a minimum SRI of 78-64.~~

~~**EXCEPTION 1 to Section 151-150.1 (f) 112:** Building integrated photovoltaic panels and building integrated solar thermal panels are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.~~

~~**EXCEPTION 2 to Section 151-150.1 (f) 112:** Roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft² are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.~~

~~12. **Ventilation Cooling.** Single family homes shall comply with the Whole House Fan (WHF) requirements shown in TABLE 150.1-A. When a WHF is required, comply with subsections i through iii below:~~

~~i. Have installed one or more WHFs whose total Air Flow CFM as listed in the CEC Directory is at least 2 CFM/ft² of conditioned floor area, and~~

~~ii. Have at least 1 square foot of attic vent free area for each 375 CFM of rated whole house fan Air Flow CFM, and~~

~~iii. Provide homeowners who have WHFs with a one page "How to operate your whole house fan" informational sheet.~~

TABLE 151-A INTERIOR MASS CAPACITY REQUIREMENTS FOR PACKAGE C

<i>FLOOR TYPE</i>	<i>MINIMUM INTERIOR MASS CAPACITY</i>
<i>slab floor</i>	<i>2.36 x ground floor area (ft²)</i>
<i>raised floor</i>	<i>0.18 x ground floor area (ft²)</i>

TABLE 151-B COMPONENT PACKAGE C

Climate Zone	1,16	3	4	5	6	7	8,9	10	2,11-13	14	15
BUILDING ENVELOPE											
Insulation minimums [†]											
Ceiling	R49	R38	R38	R38	R38	R38	R38	R49	R49	R49	R49
Wood-frame walls	R29	R25	R25	R25	R21	R21	R21	R25	R29	R29	R29
—“Heavy-mass” walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
—“Light-mass” walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
—Below-grade walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
—Slab-floor-perimeter	R7	R7	R7	R7	R7	R7	R7	R7	R7	R7	R7
—Raised floors	R30	R30	R30	R30	R21	R21	R21	R30	R30	R30	R21
—Concrete raised floors	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radiant Barrier	NR	NR	REQ	NR	NR	NR	REQ	REQ	REQ	REQ	REQ
Roofing Products	See TABLE 151-C, COMPONENT PACKAGE D										
WENESTRATION											
—Maximum U-factor ²	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
—Maximum Solar Heat Gain Coefficient (SHGC) ³	NR	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
—Maximum total area	14%	14%	14%	16%	14%	14%	14%	16%	16%	14%	16%
—Maximum West-facing area	NR	NR	5%	NR	NR	5%	5%	5%	5%	5%	5%
THERMAL MASS⁴	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
SPACE HEATING⁵											
—Electric-resistant allowed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
—If gas, AFUE=	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
—If heat pump, HSPF ⁶ =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
SPACE COOLING											
—SEER=	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
—If split system, —Refrigerant charge measurement or charge indicator display	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ
Central Forced Air Handler:	See TABLE 151-C, COMPONENT PACKAGE D										
DUCTS											
—Duct sealing	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ

Duct Insulation	R-8										
WATER HEATING System shall meet Section 151(f)8 or Section 151(b)1 ²											

TABLE 151-C – COMPONENT PACKAGE D

			Climate Zone															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Insulation minimums ¹	Ceilings		R38	R30	R30	R30	R30	R30	R30	R30	R30	R30	R38	R38	R38	R38	R38	R38
	Walls	Wood-frame walls	R21	R13	R13	R13	R13	R13	R13	R13	R13	R13	R19	R19	R19	R21	R21	R21
		Heavy-mass walls	R4.76	R2.44	R2.44	R2.44	R2.44	R2.44	R2.44	R2.44	R2.44	R2.44	R4.76	R4.76	R4.76	R4.76	R4.76	R4.76
		Light-mass walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Below-grade walls	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R13
	Floors	Slab floor perim.	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	R7
		Raised floors	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19
Concrete raised floors		R8	R8	R0	R0	R0	R0	R0	R0	R0	R0	R8	R4	R8	R8	R4	R8	
Radiant Barrier			NR	REQ	NR	REQ	NR	NR	NR	REQ	NR							
Roofing Products	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.55	NR	0.55	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR
	Steep Sloped (less than 5 lb/ft ²)	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR
	Steep Sloped (5 lb/ft ² or more)	Aged Solar Reflectance	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
		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	0.75
Fenestration	Maximum U-factor ²		0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
	Maximum Solar Heat Gain Coefficient (SHGC) ³		NR	0.40	NR	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.35	NR
	Maximum Total Area		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Maximum West-Facing Area		NR	5%	NR	5%	NR	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	NR
THERMAL MASS ⁴			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
SPACE-HEATING ^{5, 10}	Electric-resistant allowed		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
	If gas, AFUE =		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	
	If heat pump, HSPF ⁶ =		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
SPACE-COOLING	SEER =		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	
	If split system, Refrigerant charge measurement or charge indicator display		NR	REQ	NR	NR	NR	NR	NR	REQ	NR							
Central Forced Air Handlers	Cooling Airflow and Watt-Draw		NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	NR
	Central Fan Integrated Ventilation System Watt-Draw		REQ	REQ	REQ ²	REQ												
DUCTS	— Duct sealing		REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	
	— Duct Insulation		R-6	R-6	R-6	R-6	R-6	R-6	R-4.2	R-4.2	R-4.2	R-6	R-6	R-6	R-6	R-8	R-8	R-8
WATER-HEATING			System shall meet Section 151(f)8 or Section 151(b)1															

SECTION 151150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR NEWLY CONSTRUCTED BUILDINGS

~~TABLE 150.1-A COMPONENT PACKAGE--A Standard Building Design~~~~TABLE 151150.1 D COMPONENT PACKAGE E~~

			Climate Zone																				
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
Building Envelope	Roof Deck ² & Roof Ceilings	Above Deck OR Below Deck & Attic Ceilings	NR	NR	NR	NR	NR	NR	NR	NR	NR	R4 U0.137	NR										
			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	R13 U0.068	R13 U0.068	R13 U0.068	R13 U0.068	R13 U0.068	R13 ³ U0.068	R13 ³ U0.068	NR			
			R38 U0.025	R30 U0.031	R38 U0.025	R38 U0.025	R38 U0.025	R38 U0.025	R38 U0.025	R38 U0.025	R38 U0.025												
	Rafter Roofs		R38 U0.028	R30 U0.034	R38 U0.028	R38 U0.028	R38 U0.028	R38 U0.028	R38 U0.028	R38 U0.028	R38 U0.028	R38 U0.028											
	Walls/Walls	Wood-frame ⁴	R21+4 U0.054	R15+4 U0.069	R21+4 U0.054	R21+4 U0.054	R21+4 U0.054	R21+4 U0.054	R21+4 U0.054	R21+4 U0.054	R21+4 U0.054	R21+4 U0.054											
		Mass Wall Interior ¹² Insulation	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R13.0 U0.070	R17.0 U0.059	
		Mass Wall Exterior ¹² Insulation	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R8.0 U0.125	R13.0 U0.070	
		Below-grade interior	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070	R13 U0.070
		Below grade Exterior	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R5.0 U0.200	R19 U0.053
	Floors	Slab perimeter	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	R7 U0.58	
		Raised	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	R19 U0.037	
		Concrete raised	R8 U0.092	R8 U0.092	R0 U0.269	R8 U0.092	R4 U0.138	R8 U0.092	R8 U0.092	R8 U0.092	R4 U0.138	R8 U0.092	R8 U0.092										
	Quality Insulation Installation		REQ	REQ	REQ	REQ	REQ	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	
	Radiant Barrier ⁵		NR	REQ	REQ	REQ	REQ	NR															
	Roofing Products	Low-sloped	Aged Solar Reflectance	NR	0.65	NR	0.65	NR	NR	NR													
Thermal Emittance			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR	NR	NR		
Steep Sloped		Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	0.20	NR	NR		
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	0.75	NR	NR		
Fenestration	Maximum U-factor ⁶		0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32		
	Maximum SHGC ⁷		NR	0.25	NR	0.25	NR	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		
	Maximum Total Area		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	
	Maximum West Facing Area		NR	5%	NR	5%	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	

TABLE 150.1-A COMPONENT PACKAGE-A Standard Building Design -Standard Building Design (continuation)

		Climate Zone																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
HVAC SYSTEM⁸	Space Heating	Electric-Resistant Allowed	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
		If gas, AFUE=	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
		If Heat Pump, HSPF⁹=	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
	Space cooling	SEER=	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
		Refrigerant Charge Measurement or Charge Indicator Display	NR	REQ	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
		Whole House Fan¹⁰	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	NR
	Central Forced System Air Handlers¹¹	Cooling Airflow and Watt Draw	NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
		Central Fan Integrated Ventilation System Watt Draw	REQ	REQ	REQ ²	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
	DUCT SYSTEM⁵	Duct Insulation	R-86	R-86	R-86	R-86	R-86	R-6	R-6	R-6	R-68	R-68	R-86	R-86	R-86	R-8	R-8	R-8	
	Water Heating	All Buildings ^{1112, 1213}	System Shall meet Section 150.1(c)8																

TABLE 151 D – COMPONENT PACKAGE E

		Climate Zone																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Insulation minimums ¹	Ceilings	R38	R30	R38	R30	R38	R38	R30	R30	R30	R30	R38	R38	R38	R38	R38	R49	
	Walls	Wood-frame walls	R21	R19	R21	R21	R21											
		Heavy-mass walls	(R4.76)	(R2.44)	(R4.76)	(R4.76)	(R4.76)	(R4.76)	(R4.76)	(R4.76)								
		Light-mass walls	NA	NA														
		Below-grade walls	R0	R13														
	Floors	Slab floor perim.	NR	R7														
		Raised floors	R19	R19														
Concrete raised floors		R8	R8	R0	R8	R4	R8	R8	R4	R8								
Radiant Barrier		NR	REQ	NR	REQ	NR	NR	NR	REQ	NR								
Roofing Products	Low-sloped	Aged Solar Reflectance	NR	0.55	NR	0.55	NR											
		Thermal Emittance	NR	0.75	NR	0.75	NR											
	Steep Sloped (less than 5 lb/ft ²)	Aged Solar Reflectance	NR	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	NR								
	Steep Sloped (5 lb/ft ² or more)	Aged Solar Reflectance	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
		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	0.75
Fenestration	Maximum U-factor ²	0.50 ⁸	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.45 ⁹	

	Maximum Solar Heat Gain Coefficient (SHGC) ³	NR	0.40	0.40	0.25	0.40	0.40	0.25	0.40	0.40	0.40	0.25	0.25	0.30	0.25	0.25	NR
	Maximum Total Area	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Maximum West Facing Area	NR	5%	NR	5%	NR	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	NR
THERMAL MASS ⁴		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SPACE-HEATING ^{5, 10}	Electric resistant allowed	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
	If gas, AFUE =	MIN ⁸	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN ⁹
	If heat pump, HSPF ⁶ =	MIN ⁸	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN ⁹
SPACE-COOLING	SEER =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
	If split system, Refrigerant charge measurement or charge indicator display	NR	REQ	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
Central Forced Air Handlers	Cooling Airflow and Watt Draw	NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	NR
	Central Fan Integrated Ventilation System Watt Draw	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
DUCTS	Duct sealing	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
	Duct Insulation	R-8	R-6	R-8	R-6	R-6	R-4.2	R-4.2	R-4.2	R-6	R-6	R-8	R-8	R-8	R-8	R-8	R-8
WATER HEATING		System shall meet Section 151(f)8 or Section 151(b)1															

Footnote requirements to TABLE 151-B, TABLE 151-C, and TABLE 151-D.

for 4 desiccant

— No Requirement (NR), or 0.60 TBD

1 — The R-values shown for ceiling, wood frame wall and raised floor are for wood frame construction with insulation installed between the framing members. For alternative construction assemblies, see Section 151(f)1A.

The heavy mass wall R-value in parentheses is the minimum R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The light mass wall R-value in brackets is the minimum R-value for the entire assembly if the heat capacity of the wall meets or exceeds the result of multiplying the bracketed minimum R-value by 0.65. Any insulation installed on heavy or light mass walls must be integral with, or installed on the outside of, the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the thermal mass requirement.

2 — The installed fenestration products shall meet the requirements of Section 151(f)3.

3 — The installed fenestration products shall meet the requirements of Section 151(f)4.

4 — If the package requires thermal mass, the thermal mass shall meet the requirements of Section 151(f)5.

5 — Thermostats shall be installed in conjunction with all space heating systems in accordance with Section 151(f)9.

6 — HSPF means "heating seasonal performance factor."

7 — Electric resistance water heating may be installed as the main water heating source in Package C only if the water heater is located within the building envelope and a minimum of 25 percent of the energy for water heating is provided by a passive or active solar system.

8 — As an alternative under Package E in climate zone 1, glazing with a maximum 0.57 U-factor and a 92% AFUE furnace or an 8.4 HSPF heat pump may be substituted for the Package E glazing U-factor requirement. All other requirements of Package E must be met.

9 — As an alternative under Package E in climate zone 16, glazing with a maximum 0.57 U-factor and a 90% AFUE furnace or an 8.4 HSPF heat pump may be substituted for may be substituted for the Package E glazing U-factor requirement. All other requirements of Package E must be met.

10 — A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time limiting device not exceeding 30 minutes.

Footnote requirements to TABLE 150.1-A:

1. The R-values/U-factors shown for ceiling, wall and raised floor are for wood-frame construction with insulation installed between the framing members. For alternative construction assemblies, see Section 150.1(c)1A and B.
2. Insulation shall be installed above (on top) or alternatively below (underneath) the roof deck sheathing. Insulation installed above the roof deck shall be a minimum R-4 or have a maximum U-factor of 0.137. Insulation installed below the roof deck shall be a minimum R-13 or have a maximum U-factor of 0.058.
3. Air permeable -insulation materials installed directly below the roof deck shall be covered with a Class II vapor retarder (0.1 < perm < 1.0) tested in accordance with the desiccant method of ASTM E 96.
4. "R-15+4" means R-15 cavity insulation plus R-4 continuous insulated sheathing.
5. When roof deck insulation is installed below the roof deck (see footnote 2) the radiant barrier shall be installed a minimum of 1.5 inches below the insulation ~~is not required.~~
6. The installed fenestration products shall meet the requirements of Section 150.1(c)3.
7. The installed fenestration products shall meet the requirements of Section 150.1(c)4.
8. Thermostats shall be installed in conjunction with all space-heating systems in accordance with Section 150.0(i).
9. HSPF means "heating seasonal performance factor."
10. Required (REQ) whole house fans shall be listed in the Appliance Efficiency Directory and capable of providing a minimum 2 cfm/square foot of conditioned floor area.
11. A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.
- 12+. Mass wall has a thermal heat capacity greater than or equal to 7.0 Btu/h-ft².

150.2 Res Additions and Alterations

SUBCHAPTER 9

LOW-RISE RESIDENTIAL BUILDINGS—ADDITIONS AND ALTERATIONS IN EXISTING LOW-RISE RESIDENTIAL BUILDINGS

SECTION 150.2 – ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS IN EXISTING BUILDINGS THAT WILL BE LOW-RISE RESIDENTIAL OCCUPANCIES

- (a) **Additions.** Additions to existing residential buildings shall meet the requirements of Sections 110.1 through 110.810, ~~Section 119,~~ and Section 150.0, and either Section 150.2(a)1 or 2.

EXCEPTION 1 to Section 150.2(a): Additions 1,000 square feet or less are exempt from:

1. The ASHRAE Standard 62.2 Section 4 requirements to provide whole-building ventilation airflow as referenced by Section 150.0(o), however all other applicable requirements of ASHRAE Standard 62.2 shall be met by the addition; and
2. Ventilation Cooling requirements of Section 150.1(c)12.

EXCEPTION 2 to Section 150.2(a): Where the space in the attic or rafter area is not large enough to accommodate the required R-value, the entire space shall be filled with insulation provided such installation does not violate Section 1203.2 of Title 24, Part 2.

EXCEPTION 3 to Section 150.2(a): The requirements of Section 110.10 and Section 150.0(r) shall not apply unless the building has an existing solar zone.

EXCEPTION 4 to Section 150.2(a): Additions of 300 square feet or less are exempt from the roofing requirements of Section 150.1(c)11.

EXCEPTION 5 to Section 150.2(a)1 and (a)2A: If the addition will increase the total number of water heaters in the building, one of the following types of water heaters may be installed and assumed to comply:

1. A natural gas or propane gas non-recirculating water-heating system that does not exceed 50 gallons capacity and has an energy factor equal to or greater than required under the Appliance Efficiency Regulations; or
2. If no type of natural gas is connected to the building, an electric non-recirculating water heater that has an energy factor equal to or greater than required under the Appliance Efficiency Regulations. For storage type water heaters the capacity shall not exceed 50 gallons; or
3. A water-heating system determined by the Executive Director to use no more energy than the one specified in Item 1 above; or if no type of natural gas is connected to the building, a water-heating system determined by the Executive Director to use no more energy than the one specified in Item 2 above.
4. The performance approach using the existing building plus addition compliance or addition alone compliance as defined in Section 150.2(a)2B, modeling the actual proposed water heating changes, may be used to show compliance, regardless of the type or number of water heater installed.

EXCEPTION 6 to Section 150.2(a): Space-Conditioning System. When heating or cooling will be extended to an addition from the existing system(s), the existing heating and cooling equipment need not comply with Part 6. The heating system capacity must be adequate to meet the minimum requirements of CBC Section 1204.1.

EXCEPTION 7 to Section 150.2(a): Space-Conditioning Ducts. When ducts are extended from an existing duct system to serve the addition, the existing duct system and the extended ducts shall meet the applicable requirements specified in Section 150.2(b)1D.

1. **Prescriptive approach.** Additions to existing buildings shall meet the following additional requirements:
 - ~~A. Fenestration in additions up to 100 square feet shall not have more than 50 square feet of fenestration area, and shall meet the U-factor and Solar Heat Gain Coefficient requirements of Package D (Sections 151(f)3A, 151(f)4 and TABLE 151-C).~~
 - ~~BA. Additions that are greater than 700 square feet shall meet the prescriptive requirements of Section 150.1(c)3, except that the total fenestration area shall be the greater of 175 square feet or 20 percent of the addition floor area, and the west-facing fenestration limit shall be the greater of 70 square feet or the requirements of Section 150.1(c)3.~~
 - ~~B. Additions up to that are 700, 1,000 square feet or less shall meet all the requirements of Package D A (Section 150.1(f)c and TABLE 151-C TABLE 150.1-A), except that the addition's total glazing area limit is the maximum allowed in Package D A plus the glazing area that was removed as a result of the construction of the addition, and the wall insulation value need not exceed R-13; in zones 2, 4, and 7-16, the west-facing fenestration area shall not be greater than 60 square feet, and shall also comply with either i or ii below:

 - ~~i. For additions that are 700 square feet or less but greater than 400 square feet the total fenestration area limit is the greater of 120 square feet or 25 percent of the conditioned floor area of the addition; or~~
 - ~~ii. For additions that are 400 square feet or less, the total fenestration area limit is the greater of 75 square feet or 30 percent of the conditioned floor area of the addition.~~~~

EXCEPTION TO SECTION 150.2(a)1B: In climate zones 2, 4, 7-15 the total allowed west-facing glazing fenestration area shall be 5 percent of the conditioned floor area of the addition plus the amount of west-facing glazing fenestration removed from the existing building as a result of the construction of the addition.

 - ~~C. Additions larger than 1,000 square feet, shall meet the ASHRAE Standard 62.2 Section 4 requirement to provide whole-building ventilation airflow. The whole-building ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit comprised of the existing dwelling conditioned floor area plus the addition conditioned floor area.~~
 - ~~C. Additions of more than 1000 square feet shall meet the prescriptive requirements of Section 151(f).~~
2. **Performance approach.** Performance calculations shall meet the requirements of Section 150.1(a) through (c), pursuant to either Item A or B, and C below.
 - ~~A. For additions alone, The addition complies if the addition alone meets the combined water heating and space conditioning energy budgets as specified in Section 150.1(b).~~
 - ~~B. For existing plus addition plus alteration compliance. The energy use of the combination of the altered existing building plus the proposed addition shall be equal to or less than the energy use of the existing building with all alterations meeting the requirements of Section 152(b)2, plus the standard energy budget of an addition that complies with Sections 151(a) through (e). When determining the standard design, the fenestration area shall be the smaller of the sum of the installed fenestration area up to 20 percent of the conditioned floor area of the addition plus glass removed from the existing building as a result of the construction of the addition or the proposed glass area in the addition. Existing plus alteration plus addition. The standard design for existing plus alteration plus addition energy use is the combination of the existing building's unaltered components to remain; existing building altered components that is the more efficient of existing conditions or the requirements of Section 150.2(b)2; plus the proposed addition's energy use meeting the requirements of Section 150.2(a)1. The proposed design energy use is the combination of existing building's unaltered components to remain and altered components energy features, plus the proposed energy features of the addition.~~

C. Additions larger than 1,000 square feet shall meet the ASHRAE Standard 62.2 Section 4 requirement to provide whole-building ventilation airflow. The whole-building ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit comprised of the existing dwelling conditioned floor area plus the addition conditioned floor area.

EXCEPTION 1 to Section 150.2(a)2B: Existing structures with a minimum R-11 insulation in framed walls showing compliance with Section 152(a)2 (Performance Approach) showing compliance with 150.2(a)2 are exempt from showing compliance with Section 150.0(c).

EXCEPTION 2 to Section 152(a): If the addition will increase the total number of water heaters in the building, one of the following types of water heaters may be installed to comply with Section 152(a)1 or Section 152(a)2A:

1. ~~A gas storage non-recirculating water heating system that does not exceed 50 gallons capacity; or~~
2. ~~If no natural gas is connected to the building, an electric storage water heater that does not exceed 50 gallons capacity, has an energy factor not less than 0.90; or~~
3. ~~A water heating system determined by the executive director to use no more energy than the one specified in Item 1 above; or if no natural gas is connected to the building, a water heating system determined by the Executive Director to use no more energy than the one specified in Item 2 above.~~

~~For prescriptive compliance with Section 152(a)1, the water heating systems requirement in Section 151(f)8 shall not apply. For performance compliance for the addition alone, only the space conditioning budgets of Section 151(b)2 shall be used; the water heating budgets of Section 151(b)1 shall not apply.~~

~~The performance approach for the existing building and the addition in Section 152(a)2B may be used to show compliance, regardless of the type of water heater installed.~~

EXCEPTION 3 to Section 152(a) Space Conditioning System: ~~When heating and/or cooling will be extended to an addition from the existing system(s), the existing heating and cooling equipment need not comply with Title 24, Part 6. The heating system capacity must be adequate to meet the minimum requirements of CBC Section 1204.1.~~

EXCEPTION 4 to Section 152(a) Space Conditioning Ducts: ~~When ducts will be extended from an existing duct system to serve the addition, the existing ducts duct system and the extended ducts shall meet the applicable requirements of specified in Section 152(b)1D.~~

EXCEPTION 5 to Section 152(a): ~~Additions 1,000 square feet or less are exempt from the requirements of Section 150(o). For additions larger than 1,000 ft², application of Section 150(o) shall be based on the conditioned floor area of the entire dwelling unit, not just the addition.~~

(b) **Alterations.** Alterations to existing residential buildings or alterations in conjunction with a change in building occupancy to a low-rise residential occupancy shall meet either Item 1 or 2 below.

1. **Prescriptive approach.** The altered component and any newly installed equipment serving the alteration shall meet the applicable requirements of Sections 110.0 through 110.108, ~~Section 119,~~ and all applicable requirements of Section 150.0(a) through (p); and

—A.— **Fenestration.** Alterations that add vertical fenestration and skylight area shall meet the total fenestration area and west facing fenestration area, U-factor, and Solar Heat Gain Coefficient requirements of Package D-Section 150.1(c) and Table 150.1-A3A and TABLE 151-C Package A), the total fenestration area and west-facing fenestration area requirements of Package D-A (Sections 150.1(f)3B and C and TABLE 151-C TABLE 150.1-A), and the Solar Heat Gain coefficient requirements of Package D-A (Section 150.1(f)4 and TABLE 151-C TABLE 150.1-C).

EXCEPTION to Section 150.2(b)1A: Alterations that add fenestration area of up to 50-75 square feet shall not be required to meet the total fenestration area and west-facing fenestration area requirements of Sections 150.1(c)3B and C. ~~The existing west-facing fenestration area shall not be increased by more than 50 square feet.~~

- B. **Replacement Fenestration:** Replacement of vertical fenestration and skylights, where existing glazing fenestration is replaced with a new manufactured fenestration product in the same orientation, and tilt and unaltered rough opening, shall meet the U-factor and Solar Heat Gain Coefficient requirements of Package D Sections 150.1(c)3A, and 150.1(c)4, and TABLE 151-C) Package A TABLE 150.1-A.

EXCEPTION to Section 150.2(b)1B: Replacement of glass for vertical fenestration up to a total area of no more than 75 square feet with a U-factor no greater than 0.40, and in climate zones 2, 4, and 6-16, a SHGC value no greater than 0.35.

NOTE: Glass replaced in an existing sash and frame, or replacement of a single sash in a multi-sash fenestration product or replacement of a single sash in a multi-sash fenestration product are considered a repairs.

- C. **New or Replacement Space-Conditioning Systems** installed as part of an alteration include all the system heating or cooling equipment (e.g. condensing unit and cooling or heating coil for split systems; or complete replacement of a package unit); and an entirely new or replacement duct system (150.2(b)1Di); and a new or replacement air handler.

New or replacement space-conditioning systems shall:

- i. Meet the requirements of Sections 150.0(h), 150.0(i), 150.0(j)2, 150.0(j)3, 150.0(m), 150.1(f)6, 150.1(c)7, 150.1(c)9, 151(f)9, and 150.1(f)10; and
- ii. Be limited to natural gas, liquefied petroleum gas, or the existing fuel type unless it can be demonstrated that the TDV energy use of the new system is more efficient than the existing system.

- D. **Altered Duct Systems - Duct Sealing:** When more than 40 feet of new or replacement space-conditioning ducts are installed in unconditioned space or indirectly conditioned space, the new ducts shall meet the applicable requirements of Sections 150.0(m)1 through 150.1(m)11, and the duct insulation requirements of TABLE 150.1-A, Package D Section 151(f)10. If ducts are installed in climate zones 2, 9, 10, 11, 12, 13, 14, 15, or 16, and the altered duct system shall be sealed, as confirmed through field verification and diagnostic testing in accordance with all applicable procedures for duct sealing of altered existing duct systems as specified in the Reference Residential Appendix RA3.1, and the leakage compliance criteria specified in Reference Residential Appendix Table RA3.1-2, conforming to either 150.2(b)1Di or 150.2(b)1Dii as follows to meet one of the following requirements:

- i. **Entirely New or Replacement Duct System.** If the new ducts form an entirely new or replacement duct system directly connected to the air handler, the measured duct leakage shall be equal to or less than 6 percent of fan the system air handler airflow as confirmed by field verification and diagnostic testing utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1.

Entirely new or replacement duct systems installed as part of an alteration shall be constructed of at least 75% new duct material and may include reused parts from the dwelling unit's existing duct system (e.g., registers, grilles, boots, air handler, coil, plenums, duct material), but only if the reused parts are accessible and they can be sealed to prevent leakage.

Entirely new or replacement duct systems shall also conform to the requirements of Section 150(m)12 and 150(m)13 and meet the airflow requirements of Reference Residential Appendix RA3; or

- ii. **Extension of an Existing Duct System.** 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 system fan-air handler airflow as confirmed by field verification and diagnostic testing utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1; or
 - b. The measured duct leakage to outside shall be equal to or less than 10 percent of system fan-air handler airflow as confirmed by field verification and diagnostic testing utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4; or

~~c. The duct leakage shall be reduced by more than 60 percent relative to the leakage prior to the installation of the new ducts and a visual inspection, including a smoke test, shall demonstrate that all accessible leaks have been sealed; or~~

~~dc. If it is not possible to meet the duct sealing requirements of either subsection Section 150.2(b)1Dii, or Section 150.2(b)1Dii, or e, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS rater utilizing the methods specified in Reference Residential Appendix RA3.1.4.3.5.~~

EXCEPTION to Section 150.2(b)1Dii: Duct Sealing. Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos.

- E. **Altered Space Conditioning System - Duct Sealing:** In all climate zones ~~2, 9, 10, 11, 12, 13, 14, 15, and 16,~~ when a space-conditioning system is altered by the installation or replacement of space-conditioning equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, ~~or cooling or heating coil, or the furnace heat exchanger~~) the duct system that is connected to the ~~new or replacement~~ **altered** space-conditioning system equipment shall be sealed, 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 ~~the~~ Reference Residential Appendix RA3.1, ~~and the leakage compliance criteria specified in Reference Residential Appendix Table RA3.1-2, conforming to one of the following requirements.~~
- i. The measured duct leakage shall be less than 15 percent of system ~~fan flow~~ **air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1;** or
 - ii. The measured duct leakage to outside shall be less than 10 percent of system ~~fan flow~~ **air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4;** or
 - ~~iii. The measured duct leakage shall be reduced by more than 60 percent relative to the measured leakage prior to the installation or replacement of the space conditioning equipment and a visual inspection, including a smoke test, shall demonstrate that all accessible leaks have been sealed; or~~
 - ~~iiiv. If it is not possible to meet the duct duct sealing requirements of either Section 150.2(b)1Ei, or Section 150.2(b)1Eii, then or iii, all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS rater utilizing the methods specified in Reference Residential Appendix RA3.1.4.3.5.~~

EXCEPTION 1 to Section 150.2(b)1E: 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 Residential Appendix RA3.

EXCEPTION 2 to Section 150.2(b)1E: Duct Sealing. Duct systems with less than 40 linear feet in unconditioned spaces.

EXCEPTION 3 to Section 150.2(b)1E: Duct Sealing. Existing duct systems constructed, insulated or sealed with asbestos.

- F. **Altered Space-Conditioning System - Mechanical Cooling:** When a space-conditioning system ~~is an air conditioner or heat pump that~~ is altered by the installation or replacement of **refrigerant-containing system components such as the compressor, condensing coil, evaporator coil, refrigerant metering device, or refrigerant piping,** non-setback thermostats shall be replaced with thermostats meeting the requirements of Section 110.2(c). Additionally, these systems shall comply with the following requirements as applicable: ~~the air handler, outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger, the following requirements shall be met: non setback thermostats shall be replaced with thermostats meeting the requirements of Section 110.2(c).~~
- ~~i. Non setback thermostats shall be replaced with setback thermostats meeting the requirements of Section 110.2(c); and~~
 - ~~ii. Meet the refrigerant charge and airflow requirements of Reference Residential Appendix RA3~~

- i. In climate zones 2, 8, 9, 10, 11, 12, 13, 14, and 15, ducted split system central air-cooled air conditioners and ducted split system air-source heat pumps shall have proper refrigerant charge confirmed through field verification and diagnostic testing in accordance with applicable procedures specified in Reference Residential Appendix Sections RA3.2.1 or RA3.2.2, or Reference Residential Appendix RA1.
- ii. In climate zones 2, 8, 9, 10, 11, 12, 13, 14, and 15, for systems other than ducted split system central air conditioners and ducted split system heat pumps, when the space conditioning system is an air-cooled air conditioner or air-source heat pump that cannot confirm proper refrigerant charge using procedures specified in Reference Residential Appendix Sections RA3.2.1 and RA3.2.2, or Reference Residential Appendix RA1, the space conditioning system installer shall submit Certificate of Installation documentation that certifies the system has correct refrigerant charge as determined in accordance with the weigh-in charging method specified in Reference Residential Appendix RA3.2.3. HERS rater field verification and diagnostic testing of the refrigerant charge for these systems shall not be required. The installation shall be inspected by a certified HERS Rater to verify the system identification information shown on the Certificate of Installation.

Additionally, the space conditioning systems shall conform to one of the following:

- a. The systems shall have a SEER equal to or greater than 14 and an EER equal to or greater than 11; or
- b. The space conditioning system shall be a non-ducted system.

EXCEPTION to Section 150.2(b)1Fii: Altered Space-Conditioning System. Packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have the weigh-in charging method performed at installation. The installer of these packaged systems shall submit Certificate of Installation documentation that certifies the system is a packaged system for which the correct refrigerant charge has been verified by the system manufacturer prior to shipment from the factory. The installation shall be inspected by a certified HERS Rater to verify the system identification information shown on the Certificate of Installation.

~~**EXCEPTION to Section 150.2(b)1Fii** Heating only systems need not comply with this requirement.~~

G. Water-Heating System. Replacement~~New~~ service water-heating systems or components shall:

- i. ~~Meet the requirements of Section 150.0(j)2; and either be:~~
 - 1. A natural gas or propane gas non-recirculating water-heating system that does not exceed 50 gallons capacity and has an energy factor equal to or greater than required under the Appliance Efficiency Regulations; or
 - 2. If no type of natural gas is connected to the building, an electric non-recirculating water heater that has an energy factor equal to or greater than required under the Appliance Efficiency Regulations. For storage type water heaters the capacity shall not exceed 50 gallons; or
 - 3. A water-heating system determined by the Executive Director to use no more energy than the one specified in Item 1 above; or if no natural gas is connected to the building, a water-heating system determined by the Executive Director to use no more energy than the one specified in Item 2 above; or
 - 4. The performance approach for the existing building and the alteration in Section 150.2(b)2 may be used to show compliance, regardless of the type of water heater installed.
 - ii. ~~Be limited to natural gas, liquefied petroleum gas, or the existing fuel type unless it can be demonstrated that the TDV energy use of the new system is more efficient than the existing system.~~
- H. Roofs. Replacements of the exterior surface of existing roofs shall meet the requirements of Section 110.8 and the applicable requirements of subsections i ~~through and~~ iii where more than 50 percent of the roof ~~or more than 1,000 square feet of roof, whichever is less,~~ is being replaced:

- i. ~~Low-rise residential buildings with steep-sloped roofs. For steep-sloped roofs, roofing products with a density of less than 5 pounds per square foot asphalt shingle products in climate zones 10 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.~~

- ~~ii. For steep-sloped roofs, roofing products with a density of 5 pounds per square foot or more in climate zones 1 through 16 shall have a minimum aged solar reflectance of 0.15 and a minimum thermal emittance of 0.75, or a minimum SRI of 10.~~

~~**ALTERNATIVE EXCEPTION TO SECTION TO 150.2(b)1Hi and ii:** The following shall be considered equivalent to Subsection i and ii:~~

- ~~a. If an actual air-space of 1.0 inch (25 mm) exists between the top of the roof deck to the bottom of the batten to allow free air movement; insulation with a thermal resistance of at least 0.85 hr•ft²•°F/Btu or at least a 3/4 inch air space is added to the roof deck over an attic; or~~
- b. Existing ducts in the attic are insulated and sealed according to Section 150.1(f)10; or
- ~~c. In climate zones 10, 12 and 13, with 1 ft² of free ventilation area of attic ventilation for every 150 ft² of attic floor area, and where at least 30 percent of the free ventilation area is within 2 feet vertical distance of the roof ridge; or~~
- d. Buildings with at least R-30-38 ceiling insulation; or
- e. Buildings with a radiant barrier in the attic meeting the requirements of Section 150.1(f)2; or
- f. Buildings that have no ducts in the attic; or
- g. In climate zones ~~10, 11, 13 and 14~~10-15, R-43 or greater ~~roof deck~~ insulation above the roof deck, vented attic.
- iii. Low-sloped roofs in climate zones 13 and 15 shall have a 3-year aged solar reflectance equal or greater than 0.55-6365 and a thermal emittance equal or greater than 0.75, or a minimum SRI of 6475.

EXCEPTION 1 to Section 150.2(b)1Hiii: Buildings with no ducts in the attic.

EXCEPTION 2 to Section 150.2(b)1Hiii: The aged solar reflectance can be met by using insulation at the roof deck specified in Table 150.2

~~Table 150.2-A - Aged Solar Reflectance - Insulation~~ Reflectance Insulation Trade off Table

<u>Aged Solar Reflectance</u>	<u>Roof Deck Insulation R-value</u>	<u>Aged Solar Reflectance</u>	<u>Roof Deck Insulation R-value</u>
<u>0.62-0.60</u>	<u>2</u>	<u>0.44-0.40</u>	<u>12</u>
<u>0.59-0.55</u>	<u>4</u>	<u>0.39-0.35</u>	<u>16</u>
<u>0.54-0.50</u>	<u>6</u>	<u>0.34-0.30</u>	<u>20</u>
<u>0.49-0.45</u>	<u>8</u>	<u>0.29-0.25</u>	<u>24</u>

- I. **Lighting.** Luminaire power and luminaire classification shall be determined in accordance with Section 130.0(c)

EXCEPTION to Section 150.2(b)1I: For lighting alterations, Light Emitting Diode (LED) modules may be hardwired into luminaire housings manufactured for use with incandescent lamps, provided the LED

modules comply with all other requirements in Section 130.0(c), are certified to the Commission in accordance with Section 110.9, and are not connected using screw-based sockets or screw-base adaptors.

2. **Performance approach.** Performance approach shall only be used for projects that include tradeoffs between two or more altered components that are listed in TABEL 150.2-B.
 - A. The altered components shall meet the applicable requirements of Sections 110.0 through 110.108, Section 119, and Sections 150.0(a) through (p); and
 - B. When the altered components do not meet the requirements specified in the sections that are stated in subsections i through viii, the standard energy budget (energy budget) shall be based on the requirements stated in those sections as follows: The standard design for an altered component shall be the higher efficiency of existing conditions or the requirements stated in Table 150.2-B. For components not being altered, the standard design shall be based on the existing conditions. When third party verification option is specified, all components proposed for alteration must be verified.

TABLE 150.2-B – The Standard Design For An Altered Component

<u>Altered Component</u>	<u>Standard Design Without Third Party Verification of Existing Conditions Shall be Based On</u>	<u>Standard Design With Third Party Verification of Existing Conditions Shall be Based On</u>
<u>Ceiling Insulation, Wall Insulation, and Raises-floor Insulation</u>	<u>The requirements of Sections 150.0(a), (c), and (d)</u>	<u>The existing insulation R value</u>
<u>Fenestration</u>	<u>The U-factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.</u>	<u>If the proposed U-factor is \leq 0.40 and SHGC value is \leq 0.35, the standard design shall be based on the existing U-factor and SHGC values as verified. Otherwise, the standard design shall be based on the U-factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.</u>
<u>Space-Heating and Space-Cooling Equipment</u>	<u>The requirements of TABLE 150.1-A.</u>	<u>The existing efficiency levels.</u>
<u>Air Distribution System – Duct Sealing</u>	<u>The requirements of Section 150.2(b)1D.</u>	
<u>Air Distribution System – Duct Insulation</u>	<u>The proposed efficiency levels.</u>	<u>The existing efficiency levels.</u>
<u>Water Heating Systems</u>	<u>The requirements of Section 150.1(b)1 without the solar water heating requirements.</u>	<u>The existing efficiency energy factor.</u>
<u>Roofing Products</u>	<u>The requirements of Section 150.2(b)1H.</u>	
<u>All Other Measures</u>	<u>The proposed efficiency levels.</u>	<u>The existing efficiency levels.</u>

- ~~i. Ceiling Insulation. The energy budget shall be based on the requirements of Section 118(d).~~
- ~~ii. Wall Insulation. The energy budget shall be based on the requirements of Section 150(e).~~
- ~~iii. Raised floor Insulation. The energy budget shall be based on the requirements of Section 150(d).~~

~~iv. Fenestration. The energy budget shall be based on the U-factor in all climate zones and SHGC value³⁵ requirements of TABLE 151-C. The allowed glass area shall be the glass area of the existing building.~~

~~v. Space Heating and Space Cooling Equipment. The energy budget shall be based on the requirements of TABLE 151-C.~~

~~vi. Ducts. The energy budget shall be based on the requirements of Section 152(b)1D.~~

~~vii. Water Heating Systems. The energy budget shall be based on requirements of Section 151(b)1.~~

~~viii. Roofing Products. The energy budget shall be based on Section 152(b)1H.~~

~~C. When the altered components meet the requirements specified in Section 152(b)2B, subsections i through viiiA, the standard energy budget shall be based on existing conditions.~~

~~DC. The proposed design shall be based on the actual values of the altered components.~~

NOTES TO SECTION 150.2(b)2:

~~A1. If an existing component must be replaced with a new component, that component is considered an altered component for the purpose of determining the standard design altered component energy budget and must meet the requirements of Section 150.2(b)2B.~~

~~B. The proposed design shall be based on the actual values of the altered components.~~

~~C2. The standard design shall assume the same geometry and orientation as the proposed design.~~

~~3. The “existing efficiency level” modeling rules, including situations where nameplate data is not available, are described in the Residential ACM Manual~~

EXCEPTION 1 to Section 150.2(b): Any dual-glazed greenhouse/garden window installed as part of an alteration complies with the U-factor requirements in Section 150.1(c)3.

EXCEPTION 2 to Section 150.2(b): The requirements of Section 110.10 and Section 150.0(r) shall not apply unless the building has an existing solar zone.

EXCEPTION 3 to Section 150.2(b): Where the space in the attic or rafter area is not large enough to accommodate the required R-value, the entire space shall be filled with insulation provided such installation does not violate Section 1203.2 of Title 24, Part 2.

EXCEPTION 4 to Section 150.2(b): Space-Conditioning Ducts. The requirements of 150.0(m)12, 150.0(m)13, 150.0(m)14, and 150.0(m)15 do not apply to altered existing duct systems.

(c) **Whole Building.** Any addition or alteration may comply with the requirements of Title 24, Part 6 by meeting the requirements for the entire building.

EXCEPTION to Section 150.2(c): The requirements of Section 110.10 and Section 150.0(r) shall not apply unless the building has an existing solar zone.

2007 CALIFORNIA MECHANICAL CODE, CALIFORNIA CODE OF REGULATIONS, TITLE 24, PART 4 CHAPTER 6, DUCT SYSTEMS

TABLE P4-A ADOPTION TABLE

CODE SECTION	CEC
Entire 2007 CMC as noted in this table ¹	
601	X
602	X
604	X
605	X
Standard 6-5	X

¹ Adopted by reference for Occupancies A, B, E, F, H, M, R, and S; see Sections 110.8 (d)3, 120.4, and 150.0 (m).

APPENDIX 1-A STANDARDS AND DOCUMENTS REFERENCED IN THE ENERGY EFFICIENCY

AIR-CONDITIONING, **HEATING** AND REFRIGERATION INSTITUTE

~~AHRI/ARI~~ 210/240-~~2008~~²⁰⁰³ Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment (~~2003~~²⁰⁰⁸ with Addendum 1)

~~ANSI/AHRI/CSA/ARI~~ 310/380-~~2004~~⁹³ Standard for Packaged Terminal Air-Conditioners and Heat Pumps (~~2004~~¹⁹⁹³)

~~AHRI/ARI~~ 320-98 Water-Source Heat Pumps

~~AHRI/ARI~~ 325-98 Ground Water-Source Heat Pumps (1998)

~~ANSI/AHRI/ARI~~ 340/360-~~2000~~²⁰⁰⁷ Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment (~~2007~~ with Addenda 1 and ~~2~~²⁰⁰⁰)

~~ANSI/AHRI/ARI~~ 365-~~2002~~²⁰⁰⁹ Commercial and Industrial Unitary Air-Conditioning Condensing Units (~~2009~~²⁰⁰²)

~~ANSI/AHRI/ARI~~ 460-~~2000~~²⁰⁰⁵ Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers (~~2005~~²⁰⁰⁰)

~~AHRI/ARI~~ 550/590-~~98~~²⁰⁰³ Performance Rating of Standard for Water-Chilling Packages Using the Vapor Compression Cycle (~~2003~~¹⁹⁹⁸)

~~ANSI/AHRI/ARI~~ 560-2000 Absorption Water Chilling and Water Heating Packages (2000)

~~AHRI~~ 680 Performance Rating of Residential Air Filter Equipment (2009)

Available from: Air-Conditioning and Refrigeration Institute

4301 North Fairfax Drive, Suite 425

Arlington, Virginia 22203

(703) 524-8800

AIR CONDITIONING CONTRACTORS OF AMERICA

Manual J – Residential Load Calculation, Eighth Edition (2003)

Available from: Air Conditioning Contractors of America, Inc.
2800 Shirlington Road, Suite 300
Arlington, VA 22206
www.acca.org
(703) 575-4477

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI Z21.10.3-2001 Gas Water Heaters, Volume 1, Storage Water Heaters with Input Ratings above 75,000 Btu/h (2001)

ANSI Z21.13-2000 Gas-Fired Low Pressure Steam and Hot Water Boilers (2000)

ANSI Z21.40.4-1996 Performance Testing and Rating of Gas-Fired, Air-Conditioning and Heat Pump Appliances (1996)

ANSI Z21.47-2001 Gas-Fired Central Furnaces (2001)

ANSI Z83.8-2002 Gas Unit Heaters and Gas-Fired Duct Furnaces (2002)

Available from: American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036
(212) 642-4900

ANSI/NSPI-5 2003 Residential Inground Swimming Pools (2003) ANSI C82.6-2005
Ballasts for High-Intensity Discharge Lamps - Methods of Measurement

Available from: Association of Pool & Spas Professionals
2111 Eisenhower Ave.
Alexandria, VA 22314
(703) 838-0083

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS (NATIONAL PUBLICATIONS)

ASHRAE Standard 55-2004 Thermal Environment Conditions for Human Occupancy

ASHRAE Standard 62.2-2007 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

ASHRAE Handbook

Applications Volume, Heating, Ventilating and Air-Conditioning Applications (~~2011~~2003)

Equipment Volume, Heating, Ventilating and Air-Conditioning Systems and Equipment (~~2008~~2009)

Fundamentals Volume, Fundamentals (~~2009~~2005)

Available from: ASHRAE
1791 Tullie Circle N.E.
Atlanta, Georgia 30329-2305
www.ashrae.org

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS (REGIONAL PUBLICATION)

ASHRAE Climatic Data for Region X Arizona, California, Hawaii, Nevada, Publication SPCDX, 1982, ISBN #20002196 and Supplement, 1994, ISBN #20002596

Available from: Order Desk
Building News
10801 National Boulevard
Los Angeles, CA 90064
(800) 873-6397 or (310) 474-7771
<http://www.bnibooks.com/>

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM C55-01	Standard Specification for Concrete Brick (2001)
ASTM C177-97	Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus (1997)
ASTM C272-01	Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions (2001)
ASTM C335-95	Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation (1995)
ASTM C518-02	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus (2002)
ASTM C731-00	Standard Test Method for Extrudability, After Package Aging, of Latex Sealants (2000)
ASTM C 732-01	Standard Test Method for Aging Effects of Artificial Weathering on Latex Sealants (2001)
ASTM C 1167-96	Standard Specification for Clay Roof Tiles
ASTM C1371-98	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers (1998)
ASTM D822-01	Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings (2001)
ASTM D1003-00	Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics (2000)
ASTM D2824-02	Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Nonfibered, Asbestos Fibered, and Fibered without Asbestos, 2002
ASTM D3805-97	Standard Guide for Application of Aluminum-Pigmented Asphalt Roof Coatings, 1997 (reapproved 2009 3)
ASTM D4798-01	Standard Test Method Accelerated Weathering Test Conditions and Procedures for Bituminous Materials (Xenon-Arc Method) (2001)
ASTM D6848-02	Standard Specification for Aluminum-Pigmented Emulsified Asphalt Used as a Protective Coating for Roofing Asphalt Roof Coatings, 2002.
ASTM E96-00	Standard Test Methods for Water Vapor Transmission of Materials
ASTM E 283-91 (1999)	Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E408-71(2008 2)	Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques (2008 2)
ASTM E972 - 96(2007)	Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight.

ASTM E1980 – 01	Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped opaque Surfaces
ASTM E2178-03	Standard Test Method for Air Permeance of Building Materials
ASTM E2357-05	Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
ASTM E779-03	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
ASTM E1677-95 (2000)	Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
ASTM C836-05	Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course (2005)
ASTM C1583-04	Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method) (2004)
ASTM D522-93a (2001)	Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings (2001)
ASTM D1653-03	Standard Test Methods for Water Vapor Transmission of Organic Coating Films (2003)
ASTM D2370-98 (2002)	Standard Test Method for Tensile Properties of Organic Coatings (2002)
ASTM D3468-99	Standard Specification for Liquid-Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing (1999)
ASTM D5870-95 (2003)	Standard Practice for Calculating Property Retention Index of Plastics (2003)
ASTM D6083-05e1	Standard Specification for Liquid Applied Acrylic Coating Used in Roofing (2005)
ASTM D6694-01	Standard Specification for Liquid-Applied Silicone Coating Used in Spray Polyurethane Foam Roofing (2001)
Available from:	American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, Pennsylvania 19428-2959 (800) 262-1373 or (610) 832-9585

CALIFORNIA BUILDING STANDARDS COMMISSION

2007 California Electrical Code
2007 California Plumbing Code
2007 California Mechanical Code
2007 California Building Code

Available from: California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936
(916) 263-0916
www.bsc.ca.gov

CALIFORNIA ENERGY COMMISSION

Appliance Efficiency Regulations

Building Energy Efficiency Standards for Residential and Nonresidential Buildings

Reference Appendices for the Building Energy Efficiency Standards for Residential and Nonresidential Buildings

Nonresidential Alternative Calculation Method (ACM) Manual

Nonresidential Compliance Manual

Residential Alternative Calculation Method (ACM) Manual

Residential Compliance Manual

Available from: California Energy Commission/Publications
1516 Ninth Street
Sacramento, CA 95814
(916) 654-5200
www.energy.ca.gov/title24.

CALIFORNIA DEPARTMENT OF CONSUMER AFFAIRS

Standards for Insulating Material

Available from: California Department of Consumer Affairs
Bureau of Home Furnishings and Thermal Insulation
3485 Orange Grove Ave
North Highlands, CA 95660
(916) 574-2041

COOLING TECHNOLOGY INSTITUTE

CTI ATC-105-00 Acceptance Test Code for Water Cooling Towers (2000)
CTI STD-201-04 Standard for the Certification of Water-Cooling Tower Thermal Performance (2004)

Available from: Cooling Technology Institute
2611 FM 1960 West, Suite A-101
Houston, Texas 77068-3730

PO Box 73383
Houston, Texas 77273-3383
(281) 583-4087

COOL ROOF RATING COUNCIL

CRRC-1 Product Rating Program Manual (2007)

Available from: Cool Roof Rating Council
1610 Harrison Street
Oakland, CA 94612
(866) 465-2523
www.coolroofs.org

HYDRONICS INSTITUTE

HI Heating Boiler Standard 86, 6th Edition, (1989)

Available from: Hydronics Institute
35 Russo Place, P.O. Box 218
Berkeley Heights, New Jersey 07922
(908) 464-8200

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA

The IESNA Lighting Handbook, Ninth Edition (2000)

Available from: IESNA
120 Wall Street, 17th Floor
New York, New York 10005-4001
(212) 248-5000
Email: iesna@iesna.org

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS

2007 California Mechanical Code

Available from: International Association of Plumbing and Mechanical Officials
2001 E. Walnut Drive South
Walnut, California 91789-2825
800 85-IAPMO (854-2766)
www.iapmo.org

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS

2007 California Building Code

Available from: International Conference of Building Officials
International Code Council Los Angeles District Office
5360 South Workman Mill Road
Whittier, California 90601-2298
(800) 284-4406
www.icbo.org

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO-13256-1 Water-Source Heat Pumps - Testing and Rating for Performance - Part 1: Water-to-Air and Brine-to-Air Heat Pumps (1998)

Available from: ISO
1, rue de Varembe
Case postale 56
CH-1211
Geneve 20, Switzerland

NATIONAL FENESTRATION RATING COUNCIL

NFRC 100 Procedures for Determining Fenestration Product U-factors (20~~1007~~)

NFRC 200 Procedures for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence (20~~1007~~)

NFRC 202 Procedure for Determining Translucent Fenestration Product Visible Transmittance at Normal Incidence (2011)

Note: This Technical document has yet not been approved by NFRC. If this document is not approved before the Building Energy Standards effective date it will be removed.

NFRC 400 Procedures for Determining Fenestration Product Air Leakage (20~~1007~~)

Available from: National Fenestration Rating Council
~~6305 Ivy Lane, Suite 1408484 Georgia Ave.~~
~~Greenbelt Silver Spring, MD 20910770~~
(301) 589-1776
Email: info@nffc.org

NSF INTERNATIONAL (FORMERLY NATIONAL SANITATION FOUNDATION)

NSF/ANSI 50 2005 Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs (2005)

Available from: NSF International
PO Box 130140
Ann Arbor, MI 48113
(734) 769-8010

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION

Residential Comfort System Installation Standards Manual (1998)

Available from: Sheet Metal And Air Conditioning Contractors National Association (SMACNA)
4201 Lafayette Center Drive
Chantilly, VA 20151-1209
(703) 803-2980
www.smacna.org

UNDERWRITERS LABORATORIES

UL 181	Standard for Safety for Factory-made Air Ducts and Connectors (1996)
UL 181A	Standard for Safety for Closure Systems for Use with Rigid Air Ducts and Air Connectors (1994)
UL 181B	Standard for Safety for Closure Systems for Use with Flexible Air Ducts and Air Connectors (1995)
UL 723	Standard for Test for Surface Burning Characteristics of Building Materials (1996)
UL 727	Standard for Oil-Fired Central Furnaces (1994)
UL 731	Standard for Oil-Fired Unit Heaters (1995)
UL 1574	Track Lighting Systems (2000)
UL 1598	Standard for Luminaires (2000)
UL 2108	Low Voltage Lighting Systems (2008)
Available from:	Underwriters Laboratories 333 Pfingsten Road Northbrook, Illinois 60062-2096 (847) 272-8800

