2019 EDITION

# SIGNIFICANT CHANGES TO THE CALIFORNIA ENERGY CODE

AMIE BROUSSEAU
KELLY MORAIRTY
CHRIS OLVERA
JAVIER PEREZ
DANIEL WONG, P.E.

CALIFORNIA BUILDING OFFICIALS

ICC INTERNATIONAL CODE COUNCIL

SIGNIFICANT CHANGES TO THE

# CALIFORNIA ENERGY CODE

2019 EDITION

**SIGNIFICANT CHANGES TO THE CALIFORNIA ENERGY CODE 2019 EDITION**

**International Code Council**

**ICC Staff :**

Executive Vice President and Director of Business Development: Mark A. Johnson

Senior Vice President, Business and Product Development: Hamid Naderi

Vice President and Technical Director of Products and Services: Doug Thornburg

Senior Marketing Specialist: Dianna Hallmark

ISBN: 978-1-955636-12-4 (soft-cover edition)
ISBN: 978-1-955636-13-1 (PDF download)

Cover Design: Julia Lange
Manager of Development: David Walls
Publications Manager: Anne Kerr
Project Editor: Valerie Necka






Errata on various ICC publications may be available at www.iccsafe.org/errata.

First Printing: May 2021

PRINTED IN THE USA

T026502

# Contents

# Preface

The purpose of *Significant Changes to the California Energy Code Code, 2019 Edition*, is to familiarize energy code professionals, building officials, fire officials, plans examiners, inspectors, design professionals, contractors, and others in the building construction industry with many of the important changes in the 2019 *California Energy Code* (CEC). This publication is designed to assist code users in identifying the specific code changes that have occurred and understanding the reasons behind the changes. It is also a valuable resource for jurisdictions in their code-adoption process.

Only a portion of the code changes to the CEC are discussed in this book. The changes selected were identified for a number of reasons, including their frequency of application, special significance, or change in application. However, the importance of the changes not included is not to be diminished. Further information on California code changes can be found in the *California Significant Code Change series,* available from the International Code Council® (ICC®). This resource series provides the published documentation for each successful code change contained in the 2019 California Building, Fire, and Residential Codes.

*Significant Changes to the California Energy Code (CEC), 2019 Edition*, is organized into nine parts, each representing a distinct grouping of code topics. It is arranged to follow the general layout of the CEC, including code sections and section number format. The table of contents, in addition to providing guidance in the use of this publication, allows for a quick identification of those significant code changes that occur in the 2019 CEC.

Throughout the book, each change is accompanied by a photograph or an illustration to assist in and enhance the reader's understanding of the specific change. A summary and a discussion of the significance of the change are also provided. Each code change is identified by type, be it an addition, modification, clarification, or deletion.

The code change itself is presented in a legislative format similar to the style utilized for code-change proposals. Deleted code language is shown with a strikethrough, whereas new code text is indicated by underlining. As a result, the actual 2019 code language is provided, as well as a comparison with the 2016 CEC language, so the user can easily determine changes to the specific code text.

As with any code-change text, *Significant Changes to the California Energy Code, 2019 Edition*, is best used as a companion to the 2019 CEC. Because only a limited discussion of each change is provided, the code itself should always be referenced in order to gain a more comprehensive understanding of the code change and its application.

The commentary and opinions set forth in this text are those of the authors and do not necessarily represent the official position of ICC. In many cases, the explanatory material is derived from the reasoning expressed by code-change proposals.

Comments concerning this publication are encouraged and may be directed to ICC at significantchanges@iccsafe.org.

## About the *California Energy Code*

Building officials, design professionals, contractors and others involved in the field of building construction recognize the need for modern, up-to-date building energy codes addressing the design and installation of building systems through both prescriptive and performance requirements. The *California Energy Code* (CEC), 2019 Edition, is intended to meet these needs for residential and commercial buildings through the development and adoption of Part 6 of the California Building Standards Code that safeguard the public health, the environment, and safety in all communities, large and small. The CEC is kept up to date through California's code-development process. The provisions of the 2016 edition, along with those code changes approved through 2019, make up the 2019 edition.

The CEC is Part 6 of the California Building Standards Code, Title 24 and is published by ICC. This comprehensive code establishes minimum regulations for residential and commercial building systems by means of prescriptive and performance-related provisions. It is founded on broad-based principles that make possible the use of new materials and new building designs. The CEC is a comprehensive code containing provisions for building energy conservation and efficiency and is applicable to buildings throughout California.

## Acknowledgments

Grateful appreciation is due to many ICC staff members for their generous assistance in the preparation of this publication, and to the following:

| | | |
|---|---|---|
| Payam Bozorgchami, P.E. | Bill Pennington | Mazi Shirakh, P.E. |
| Peter Strait | Todd Ferris | Larry Froess, P.E. |
| Simon Lee, P.E. | Jeff Miller, P.E. | Ronald Balneg |
| Dee Anne Ross | Michael Shewmaker | Alexis Smith |
| Danny Tam | RJ Wichert | Thao Chau |
| Allen Wong | Paula David | Jose Perez |
| Kevin Mouayang | Jennica Limcaco | Safa Bakhshi |
| Elizabeth Ferris | Hamed Amouzgar | |

# About the Authors

**Javier Perez**

Javier Perez is an Energy Commission Specialist in the California Energy Commission's Outreach and Education Unit. He started at the Energy Commission in 2008 as a student on the Energy Standards Hotline. Through his years of experience at the Energy Commission, Javier has become one of the foremost experts on the California Energy Code. He develops and provides training on the Energy Code throughout California.

**Daniel Wong, P.E.**

Daniel Wong is a senior electrical engineer in the California Energy Commission's Standards Compliance Office. He specializes in the lighting and electrical power distribution system requirements and helps develop training, tools, and resources to assist enforcement agencies verify compliance with the California Energy Code. Daniel has been working in energy efficiency since 2011 performing research, evaluation, implementation, and outreach activities.

**Amie Brousseau**

Amie Brousseau is an Energy Commission Specialist in the California Energy Commission's Outreach and Education unit. She specializes in the building envelope requirements, helping to develop resources and training materials to simplify the California Energy Code. Amie is the current editor of the Blueprint newsletter. She has been working in energy efficiency for 10 years doing energy audits, benchmarking, Energy Code presentations, and outreach to stakeholders. Amie also does project and contract management.

**Kelly Morairty**

Kelly Morairty joined the California Energy Commission in 2016 and works as a mechanical engineer in the Building Standards Office, Outreach and Education Unit. He specializes in HVAC requirements and helps develop training, tools, and resources to assist building industry stakeholders with compliance with the California Energy Code.

**Christopher Olvera**

Christopher Olvera has over 17 years of experience working at the California Energy Commission. He began work as a student on the Energy Standards Hotline fielding questions from designers, builders, and enforcement agencies statewide regarding the Energy Code. At the Energy Commission, Chris has served in several other positions supporting a variety of programs, including the HERS, ATTCP, Compliance and Enforcement, Low Interest ECCA Loans, Bright Schools, and Proposition 39. Currently, Chris is the Supervisor of the Outreach and Education Unit that develops training tools, presentations, and resources to assist enforcement agencies verify compliance with the California Energy Code.

# About the California Energy Commission

The California Energy Commission is the state's primary energy policy and planning agency. It has seven core responsibilities: advancing state energy policy, encouraging energy efficiency, certifying thermal power plants, investing

in energy innovation, developing renewable energy, transforming transportation, and preparing for energy emergencies. Established in 1975 by the Warren-Alquist Act to respond to the energy crisis of the early 1970s, the agency's research, programs and policies remain crucial today as the state plans for 100-percent clean energy and carbon neutrality by midcentury.

## About CALBO

California Building Officials is a nonprofit corporation dedicated to promoting public health and safety in building construction through responsible legislation, education, and building code development. CALBO was founded in 1962 to promote and further the profession of the local California Building Official. With time and achievement, the organization has become the advocate and representative of not only the local California Building Official, but of local building departments, local government entities, and public safety and code enforcement officials.

1022 G Street
Sacramento, CA 95814

(916) 457-1103

info@calbo.org

## About the International Code Council®

The International Code Council is a nonprofit association that provides a wide range of building safety solutions including product evaluation, accreditation, certification, codification and training. It develops model codes and standards used worldwide to construct safe, sustainable, affordable and resilient structures. ICC Evaluation Service (ICC-ES) is the industry leader in performing technical evaluations for code compliance, fostering safe and sustainable design and construction.

**Washington DC Headquarters:**
500 New Jersey Avenue, NW, 6th Floor
Washington, DC 20001

**Regional Offices:**
Eastern Regional Office: (BIR)
Central Regional Office: (CH)
Western Regional Office: (LA)
Distribution Center (Lenexa, KS)

Washington D.C. 1-888-ICC-SAFE (422-7233)
www.iccsafe.org

**Family of Solutions:**

PART 1

# All Occupancies—General Provisions

## Subchapter 1

Subchapter 1 is comprised of three sections: 100.0, 100.1, and 100.2. Section 100.0 addresses the general provisions of the *California Energy Code*. It defines which buildings are covered, spaces of buildings that are regulated, and how the sections apply to different types of construction. Table 100.0-A summarizes which sections of the Energy Code apply based on the occupancy of the building, and type of construction, whether newly constructed, addition, or alteration.

Section 100.1 establishes definitions for terms used within the Energy Code. If a term used in the Energy Code is not defined in this section, the Energy Code defers to Parts 1 through 5 of the California Code of Regulations. If no definition for a term exists in Parts 1 through 6, the Energy Code defers to *Webster's Third New International Dictionary of the English Language, Unabridged* I1961 edition, through 2002 addenda), unless the context requires otherwise. This section also identifies California's 16 building climate zones in Figure 100.0-A.

Section 100.2 summarizes the calculation of Time Dependent Valuation (TDV) energy. TDV energy is used to compare proposed buildings to buildings of the same geometry, orientation, and location, that meet all mandatory and prescriptive requirements of the Energy Code. This comparison of energy use is how the performance approach determines the compliance of a building with the Energy Code's requirements. TDV energy accounts for fluctuations in energy costs and assigns multipliers for each hour of the year, by energy type (electricity, natural gas, or propane), by climate zone, and by building type. ■

# 100.0(a)
## Buildings Covered

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Buildings that are Occupancy Group I-1 and I-2 are now covered by the 2019 Energy Code, and the code language was simplified.

**2019 CODE:**

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

1. That are of Occupancy Group A, B, E, F, H, I, 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; or
   B. Indirectly or directly conditioned ~~by mechanical heating or mechanical cooling,~~ or process spaces~~;~~ . ~~or~~
   ~~C. Low-rise residential buildings that are heated with a non-mechanical heating system.~~

**EXCEPTION 1 to Section 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 100.0(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.

**EXCEPTION 3 to Section 100.0(a):** Buildings in Occupancy Group I-3 and I-4.

**CHANGE SIGNIFICANCE:** Section 100.0(a) has expanded the scope of the Energy Code to now include some buildings that are of Occupancy Group I. Requirements for Occupancy Group I buildings have been excluded from the scope of the Energy Code since 1982. For a description of buildings that are categorized as Occupancy Group I (Institutional), see Section 308 of the *California Building Code* (Title 24, Part 2).

Exception 3 to Section 100.0(a) was added to exclude Occupancy Groups I-3 and I-4 from the scope. Staff found that the analysis conducted for prior standards are not as readily applicable to I-3 and I-4 occupancies. This Exception is therefore necessary to prevent applying existing standards to these occupancies ahead of additional analysis.

Section 100.0(a)3B was modified to simplify the description of buildings regulated by the Energy Code. The definition of "conditioned space" already uses the terms mechanical heating, mechanical cooling, and wood heating, with wood heating being nonmechanical heating. This change clarifies without materially altering the requirements, and is necessary to improve clarity and consistency.

Similarly, Section 100.0(a)3C was also modified to simplify the description of buildings regulated by the Energy Code. The definition of conditioned space already uses the term "wood heating." This change clarifies without materially altering the requirements and is necessary to improve clarity and consistency.


*International Code Council®*

Healthcare Facilities – Healthcare facilities are now regulated by the Energy Code. Specifically, Occupancy Groups I-1 and I-2 have been added to the scope of the Energy Code.

# 100.0(e)

## Sections Applicable to Particular Buildings

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** An exception to the low-rise residential prescriptive and performance requirements was removed.

**2019 CODE:**

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

[…]

2. **Newly constructed buildings.**

[…]

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.** In order to comply with Part 6, newly constructed low-rise residential buildings must meet the requirements of:

a. Mandatory measures: The applicable provisions of Sections 110.0 through 110.10, and 150.0; and

b. Either:

(i) Performance approach: Sections 150.1(a) and (b); or

(ii) Prescriptive approach: Sections 150.1(a) and (c).

**EXCEPTION 1 to Section 100.0(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 100.0(e)2Diib:** Low-rise residential buildings that are heated with a wood heater or another nonmechanical heating system and that use no energy obtained from depletable sources for lighting or water heating.~~

[…]

**CHANGE SIGNIFICANCE:** Exception 2 to Section 100.0(e)2Diib was modified to eliminate a conflict with Section 100.0(a)3C, in that a low-rise residential building heated with nonmechanical heat are under the scope of the Energy Code. Also, with the prescriptive requirement for photovoltaic panels, this exception could have been a loophole for low-rise residential buildings to not have to comply those requirements. This change is necessary to eliminate that potential loophole. More on the prescriptive photovoltaic system requirements can be found in Section 150.1(c)14 of the 2019 Energy Code.

# 100.1(b)

## Definitions – Conditioned Spaces

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** The definitions related to "Conditioned Space" were reworded for clarity.

**2019 CODE:**

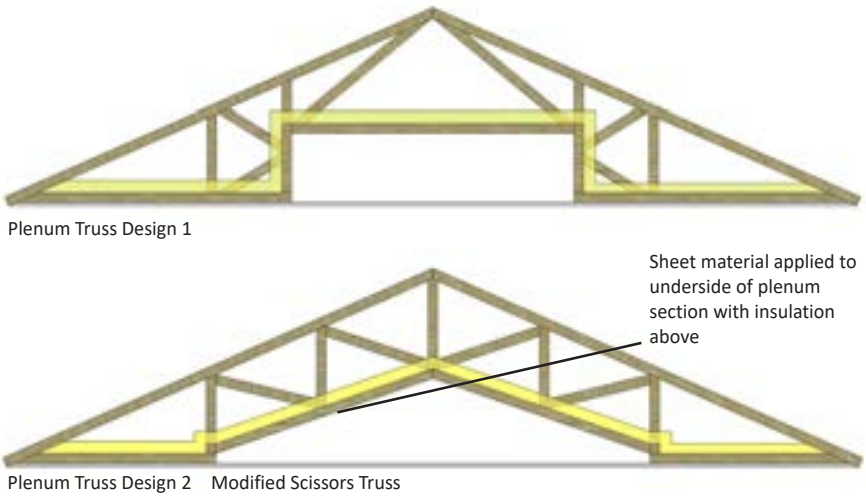
**CONDITIONED SPACE** is an enclosed space within a building that is ~~either~~ directly conditioned or indirectly conditioned.

**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-ft$^2$, or ~~is provided with~~ mechanical cooling that has a capacity exceeding 5 Btu/hr-ft$^2$, ~~unless the space-conditioning system is designed for process space or process load~~. Directly conditioned space does not include process space. (See ~~"process load" and~~ "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.

**CHANGE SIGNIFICANCE:** The purpose of the changes to the definitions related to conditioned space is to remove unnecessary language and improve phrasing. Spaces that are conditioned and kept between and including 55 and 90 degrees are subject to all applicable requirements of the Energy Code. Whether or not that space conditioning system is for a process or for human comfort does not change this. Commercial plant growth facilities typically fall into this category. While the space conditioning systems that serve these areas are not for human comfort, this space is not considered "process space," and thus is subject to all applicable requirements for conditioned spaces.

The language excluding "process spaces" was added to the definition of "conditioned space, directly" to explicitly omit spaces with space heating or cooling that are kept below 55 degrees, or above 90 degrees. See the definition for "process space" for more on how these spaces are classified. These changes clarify without materially altering the requirements of the Energy Code.




Indirectly Conditioned Attic Spaces – The spaces below the yellow insulation but above the ceiling line are considered indirectly conditioned spaces.
Source: California Energy Commission, 2019 Residential Compliance Manual

# 100.1(b)

## Definitions – Door

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** The threshold for when a door is considered a glazed door has been reduced from 50% glazing to 25%.

**2019 CODE:**

**DOOR** is an operable opening in the building envelope, including swinging and roll-up doors, fire doors, pet doors and access hatches with less than ~~50~~25 percent glazed area. When that operable opening has ~~50~~25 percent or more glazed area it is a glazed door. See Fenestration: Glazed Door.

**CHANGE SIGNIFICANCE:** The purpose of the changes made to this definition is to reduce the threshold of glazed doors from 50% glazing to 25%. This change was made to align the Energy Code's definition with the National Fenestration Rating Council's (NFRC) definition. As a result, more doors will fall under the definition of a "glazed door," and thus will be subject to *U*-factor and solar heat gain coefficient (SHGC) requirements.

Getty Images

Entrance Door with 25% or More Glazing – Doors with 25% or more glazing are now considered glazed doors under the 2019 Energy Code. This is a change from the 50% threshold of the 2016 Energy Code.

# 100.1(b)

## Definitions – Energy Design Rating

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** The 2019 Energy Code has changed how performance compliance is measured for newly constructed low-rise residential buildings, and these definitions were added for clarification and understanding of the new terms.

**2019 CODE:**

**ENERGY DESIGN RATING (EDR)** is a way to express the energy consumption of a building as a rating score index where a score of 100 represents the energy consumption of the building built to the specifications of the Residential Energy Services (RESNET) reference home characterization of the 2006 *International Energy Conservation Code* (IECC) with Title 24, Part 6 modeling assumptions, and a score of 0 (zero) represents a building that has zero net energy consumption. The EDR is calculated using Commission-approved compliance software as specified by the Alternative Calculation Method Approval Manual.

**ENERGY DESIGN RATING, ENERGY EFFICIENCY** is an Energy Design Rating based on the TDV energy consumption of a building that results from the building's energy efficiency characteristics, calculated using Commission-approved compliance software as specified by the Alternative Calculation Methods Approval Manual.

**ENERGY DESIGN RATING, SOLAR ELECTRIC GENERATION AND DEMAND FLEXIBILITY** is the reduction in TDV energy consumption of a building expressed in terms of an Energy Design Rating reduction that results from the combination of the building's solar electric generation system and demand flexibility measures.

**ENERGY DESIGN RATING, TOTAL** is the total Energy Design Rating for the building that is determined by subtracting the Solar Electric Generation System and Demand Flexibility Energy Design Rating from the Energy Efficiency Energy Design Rating.

**CHANGE SIGNIFICANCE:** The 2019 Energy Code has changed how compliance for newly constructed low-rise residential buildings via the performance approach is measured. These buildings now must comply with maximum Energy Design Rating scores. The purpose of adding these definitions is to clarify the meaning of these terms.

The EDR score enables a comprehensive focus that maximizes the ability for newly constructed buildings to be designed and built to be harmonized with California's electricity grid, consistent with the policies of the Commission's sister agencies, CALISO, CPUC and ARB, to contribute to achievement of California's climate change goals at lowest cost. For the first time this EDR metric is incorporated into the Energy Code for newly constructed, low-rise buildings.

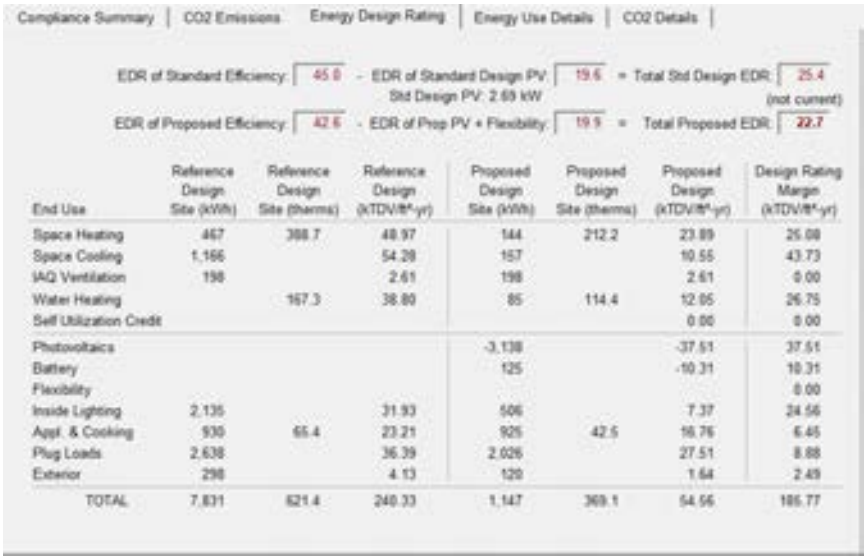
An EDR score of 100 represents a building that consumes the amount of energy that a building built to the 2006 *International Energy Conservation Code* would have consumed. A score of 0 represents a building that produces at least the same amount of energy it consumes over one year, making it a zero net energy building.

For compliance with the 2019 Energy Code, two EDR scores must be met independently:

1. Efficiency EDR, which represents that EDR score of 100, minus energy savings for space heating, cooling, ventilation, water heating, plus a limited credit for battery, and
2. Total EDR, which represents the Efficiency EDR minus a compliance credit for a photovoltaic system (PV), battery, and other demand flexibility measures if modeled.

The Efficiency EDR score will generally be in the range of 41–48 and will vary by climate zone and building size. Once PV is added into the equation, the Total EDR score will generally be in the range of 15–27.

For the first time, the Energy Code is also recognizing the installation of a battery system, and demand flexibility measures. These options can assist with achieving the maximum EDR scores for the buildings they're designed in.



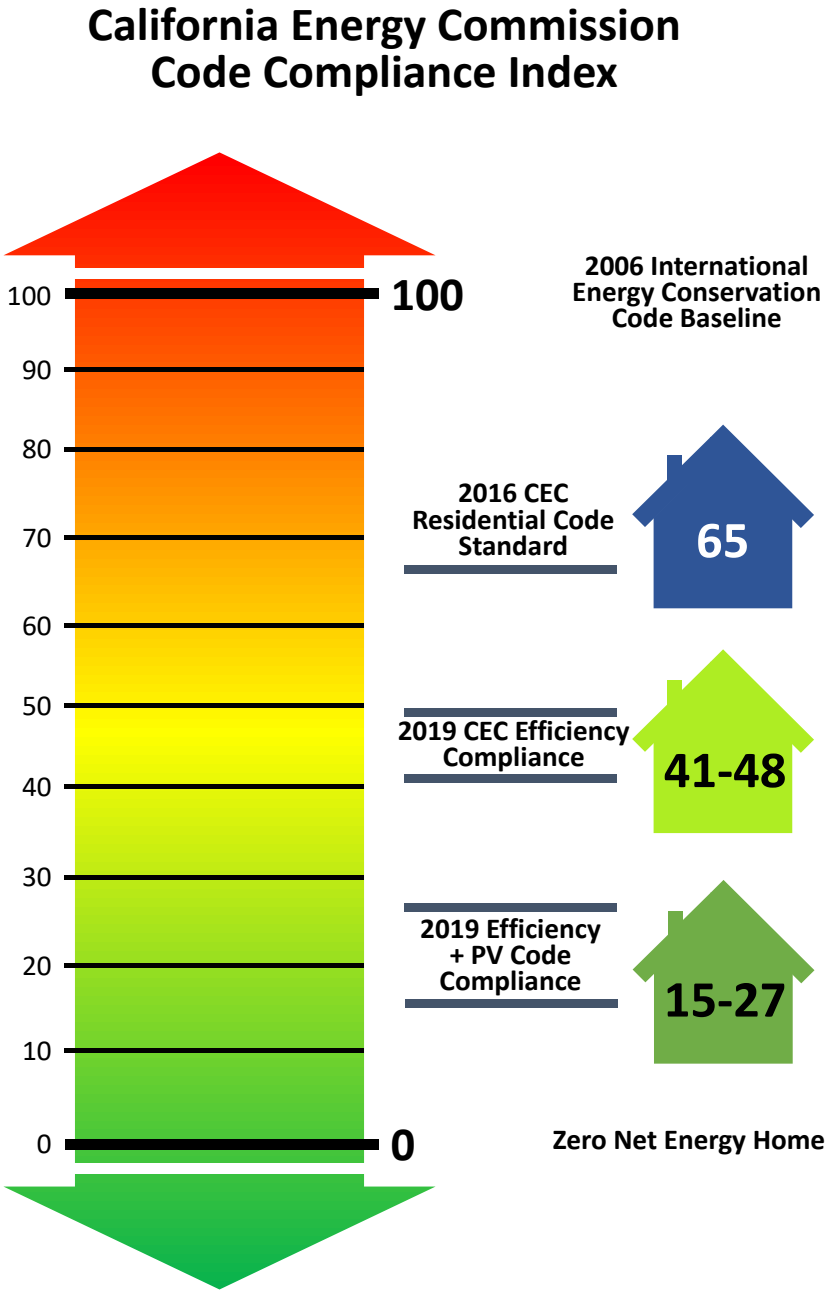
Compliance Summary | CO2 Emissions | Energy Design Rating | Energy Use Details | CO2 Details

EDR of Standard Efficiency: 45.0 - EDR of Standard Design PV: 19.6 = Total Std Design EDR: 25.4 (not current)
Std Design PV: 2.69 kW

EDR of Proposed Efficiency: 42.6 - EDR of Prop PV + Flexibility: 19.9 = Total Proposed EDR: 22.7

| End Use | Reference Design Site (kWh) | Reference Design Site (therms) | Reference Design (kTDV/ft²-yr) | Proposed Design Site (kWh) | Proposed Design Site (therms) | Proposed Design (kTDV/ft²-yr) | Design Rating Margin (kTDV/ft²-yr) |
|---|---|---|---|---|---|---|---|
| Space Heating | 467 | 388.7 | 48.97 | 144 | 212.2 | 23.89 | 25.08 |
| Space Cooling | 1,166 | | 54.28 | 157 | | 10.55 | 43.73 |
| IAQ Ventilation | 198 | | 2.61 | 198 | | 2.61 | 0.00 |
| Water Heating | | 167.3 | 38.80 | 85 | 114.4 | 12.05 | 26.75 |
| Self Utilization Credit | | | | | | 0.00 | 0.00 |
| Photovoltaics | | | | -3,138 | | -37.51 | 37.51 |
| Battery | | | | 125 | | -10.31 | 10.31 |
| Flexibility | | | | | | | 0.00 |
| Inside Lighting | 2,135 | | 31.93 | 506 | | 7.37 | 24.56 |
| Appl. & Cooking | 930 | 65.4 | 23.21 | 925 | 42.5 | 16.76 | 6.45 |
| Plug Loads | 2,638 | | 36.39 | 2,026 | | 27.51 | 8.88 |
| Exterior | 298 | | 4.13 | 120 | | 1.64 | 2.49 |
| TOTAL | 7,831 | 621.4 | 240.33 | 1,147 | 369.1 | 54.56 | 185.77 |

Example Energy Design Rating (EDR) Score: Under the 2019 Energy Code, low-rise residential buildings must now comply with two scores: a maximum efficiency EDR, and a maximum total EDR.
Source: California Energy Commission

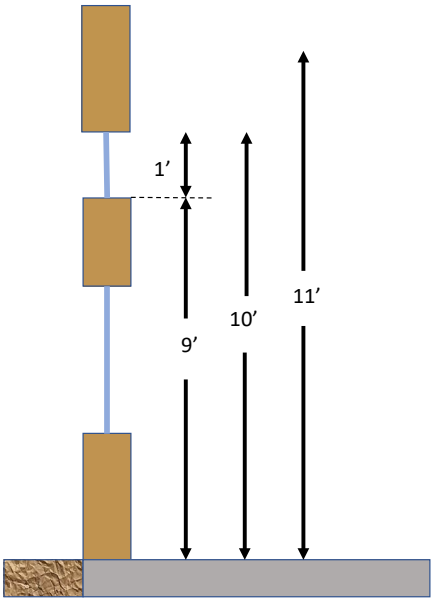



Energy Design Rating (EDR), as defined by the California Energy Commission, is an alternate way to express the energy performance of a building using a scoring system where 100 represents the energy performance of a Residential Energy Services (RESNET) reference home characterization of the 2006 IECC with California modeling assumptions. A score of 0 represents the energy performance of a building that combines high levels of energy efficiency with renewable generation to "zero out" its TDV energy.

California's Energy Design Rating Sample Scale – An EDR score of 100 represents a low-rise residential building built to the 2006 *International Energy Conservation Code*. A low-rise residential building built to the 2019 Energy Code, including the new photovoltaic system requirements, will generally have an EDR score between 15 and 27.
Source: California Energy Commission

# 100.1(b)

## Definitions – Fenestration




Clerestory – To qualify for a lighting power adjustment factor, clerestory fenestration must meet the requirements of Section 140.6(d)1.
Source: California Energy Commission

**CHANGE TYPE:** Addition and Clarification

**CHANGE SUMMARY:** Definitions were added for different fenestration types, and fenestration definitions were altered for clarity.

**2019 CODE:**

**FENESTRATION:** Includes the following:

[…]

~~**ALTERATION** is any change to an existing building's exterior fenestration product that is not a repair (see Fenestration Repair) that:~~

~~i. Replaces existing fenestration in an existing wall or roof with no net area added; or~~

~~ii. Replaces existing fenestration and adds new net area in the existing wall or roof; or~~

~~iii. Adds a new window that increases the net fenestration area to an existing wall or roof.~~

[…]

**CLERESTORY** is fenestration installed above a roofline greater than or equal to 60° from the horizontal, or any portion of exterior vertical glazing greater than eight feet per floor above the finished floor of a space.

[…]

**FENESTRATION ALTERATION** is any change to an existing building's exterior fenestration product that is not a repair (see "fenestration repair") that:

i. Replaces existing fenestration in an existing wall or roof with no net area added; or

ii. Replaces existing fenestration and adds new net area in the existing wall or roof; or

iii. Adds a new window that increases the net fenestration area to an existing wall or roof.

**FENESTRATION AREA** is the rough opening area of any fenestration product. ~~for windows is the total window rough opening area which includes the fenestration, fenestration frame components in the exterior walls and roofs.~~

**FENESTRATION PRODUCT** is any transparent or translucent material plus any sash, frame, mullions and dividers, in the facade of a building, including, but not limited to, windows, ~~sliding glass doors~~, ~~french~~glazed doors, skylights, curtain walls, dynamic glazing, garden windows and glass block.

[…]

**GLAZED DOOR** is an exterior door having a glazed area of ~~50~~25 percent or greater of the area of the door. Glazed doors shall meet fenestration product requirements. See "door".

[…]

**HORIZONTAL SLATS,** when referring to a daylighting device, is a set of adjacent surfaces located directly adjacent to vertical fenestration,

oriented horizontally and projecting horizontally from its interior or exterior vertical surface.

**LIGHT SHELF** is an adjacent, opaque surfaced daylighting device located at the sill of clerestory glazing, oriented horizontally and projecting horizontally from an interior or exterior vertical surface.

[…]

**SKYLIGHT ROOF RATIO (SRR)** is the ratio of the skylight area to the gross exterior roof area.

[…]

**VERTICAL FENESTRATION** is all fenestration other than skylights and doors.

**VISIBLE REFLECTANCE** is the reflectance of light at wavelengths from 410 to 722 namometers.

[…]

**WINDOW HEAD HEIGHT** is the height from the floor to the top of the ~~window~~vertical fenestration.

**CHANGE SIGNIFICANCE:** Clerestory Glazing – The purpose of adding this definition is to include a key term consistent with the proposed addition of clerestory glazing as a power adjustment factor in Section 140.6. This change is necessary to ensure clarity and specificity where this new measure is proposed.

Glazed Door – The purpose of the changes made to this definition is to reduce the threshold for glazed doors from 50% to 25%. This change is necessary to provide clarity and better align with the NFRC definitions.

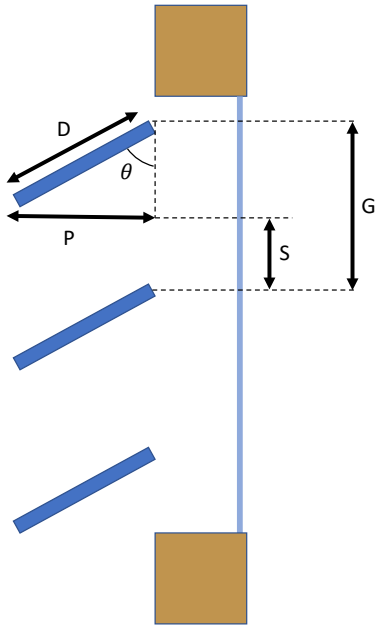
Fenestration Alteration – The purpose of adding this definition is to move and clarify definition language and remove redundant definitions. The term "alteration" is defined generally, and was also defined specifically in relation to fenestration, which made it appear that the term "alteration" had two definitions in Section 100.1. This addition provides that same definitional language as defining the term "fenestration alteration." This change clarifies without materially altering the requirements of the Energy Code.

Fenestration Area – The purpose of the changes made to this definition is to reduce redundancy and provide clarity. This change is necessary to eliminate the confusion caused by having two definitions for fenestration area (one for nonresidential and one for low-rise residential) and to use simpler and more comprehensive language.

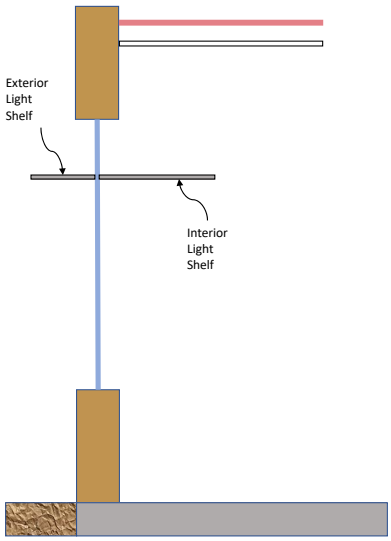
Horizontal Slats – The purpose of adding this definition is to include a key term consistent with the proposed addition of horizontal slats as a power adjustment factor in Section 140.6. This change is necessary to ensure clarity and specificity where this new measure is proposed.

Light Shelf – The purpose of adding this definition is to include a key term consistent with the proposed addition of light shelves as a power adjustment factor in Section 140.6. This change is necessary to ensure clarity and specificity where this new measure is proposed.

Skylight Roof Ratio (SRR) – The purpose of adding this definition is to define the elements that are used to calculate the skylight roof ratio, and to provide support for use of an acronym in place of the full term.




Horizontal Slats – To qualify for a lighting power adjustment factor, horizontal slats must meet the requirements of Section 140.6(d)2.
Source: California Energy Commission




Lighting Shelves – To qualify for a lighting power adjustment factor, lighting shelves must meet the requirements of Section 140.6(d)2.
Source: California Energy Commission

This change is necessary to support and provide clarity to the provisions of the Energy Code that relate to skylights.

Vertical Fenestration – The purpose of adding this definition is to create an inclusive term for all windows and other building penetrations and openings that act like windows, and to clarify that the use of the term is intended to exclude skylights (which are not typically installed vertically) and doors (which are subject to separate requirements). This change is necessary to clearly categorize the types of fenestration that are subject to the requirements of the Energy Code.

Window Head Height – The purpose of the change to this definition is to use the new term "vertical fenestration" in order to ensure appropriate application of the window requirements. This change clarifies without materially altering the requirements of the Energy Code.

# 100.1(b)

## Definitions – Habitable Areas

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Definitions for "Habitable Space" and "Habitable Story" were updated for clarity.

**2019 CODE:**

**HABITABLE SPACE** is space in a building for living, sleeping, eating or cooking, excluding ~~B~~bathrooms, toilets, hallways, storage areas, closets, ~~or~~ utility rooms and similar areas ~~are not considered habitable spaces~~. (See also "occupiable space".)

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

**CHANGE SIGNIFICANCE:** The purpose of the changes to these definitions is to simplify phrasing, ensure consistency between the definitions, and create consistency between these terms and with the terms relating to occupancy. For residential buildings, only habitable stories count towards the 3-story delineation. This change clarifies without materially altering the requirements of the Energy Code.

# 100.1(b)

## Definitions – Healthcare Facility

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** The scope of the Energy Code has expanded to include Occupancy Group I-1 and I-2, and for this reason, the definition of a "Healthcare Facility" was added.

**2019 CODE:**

**HEALTHCARE FACILITY** is any building or portion thereof licensed pursuant to California Health and Safety Code Division 2, Chapter 1, §1204 or Chapter 2, §1250.

**CHANGE SIGNIFICANCE:** The purpose of adding this definition is to specifically and accurately define when a building or space can be considered a healthcare facility. It is necessary because the scope of the code has expanded to include Occupancy Groups I-1 and I-2, and many of these facilities require a number of special exceptions in order to protect health and safety. The definition allows the Energy Code to defer to the California Department of Public Health, which issues the specified licenses, with respect to which facilities should be eligible for exceptions. This definition was developed under close coordination with the Office of Statewide Health Planning and Development (OSHPD) and the healthcare industry.

Getty Images

Healthcare Facility – Occupancy Groups I-1 and I-2, including healthcare facilities, have been added to the scope of the Energy Code.

# 100.1(b)
## Definitions – Lighting

**CHANGE TYPE:** Addition, Clarification, and Modification

**CHANGE SUMMARY:** Definitions to different terms related to lighting were added and altered for clarity and consistency with other sections of the Energy Code.

**2019 CODE:**

**LIGHTING** definitions:

[…]

**Compact Fluorescent Lamp** is a single-ended fluorescent lamp ~~less than nine inches maximum overall length~~ with a T5 or smaller diameter glass tube that is folded, bent, or bridged.

[…]

**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, ~~designed with a base to provide an electrical connection between the lamp and a luminaire~~, and designed to be installed into a luminaire. A lamp is not a luminaire and is not an LED retrofit kit ~~by means of a lampholder integral to the luminaire~~.

[…]

**LED Retrofit Kit** is a solid state lighting product intended to replace existing light sources and systems, including incandescent and fluorescent light sources, in previously installed luminaires that already comply with safety standards. These kits replace the existing light source and related electrical components, and are classified or certified to UL 1598C. They may employ an ANSI standard lamp base, either integral or connected to the retrofit by wire leads. LED retrofit kit does not include self-ballasted lamps.

**Non-integrated LED lamp** is an assembly composed of a light emitting diode (LED) array (module) or LED packages (components), and an ANSI standard base. The device is intended to connect to the LED driver of an LED luminaire through an ANSI standard lamp-holder (socket). The device cannot be connected directly to the branch circuit. ~~an assembly comprised of an LED array (module) or LED packages (components) and ANSI standard base. The device is intended to connect to the LED driver of an LED luminaire through an ANSI standard lamp-holder (socket). The device cannot be connected to the branch circuit~~ (ANSI/IES RP-16-17~~10~~).

**Integrated LED lamp** is an integrated assembly composed of light emitting diode (LED) packages (components) or LED arrays (modules), as well as an LED driver, an ANSI standard base, and other optical, thermal, mechanical and electrical components. The device is intended to connect directly to the branch circuit through a corresponding ANSI standard lamp-holder (socket). ~~an integrated assembly comprised of LED packages (components) or LED arrays (modules), LED driver, ANSI standard base and other optical, thermal,~~

~~mechanical and electrical components. The device is intended to connect directly to the branch circuit via a corresponding ANSI standard lamp-holder (socket)~~ (ANSI/IES RP-16-17~~10~~).

[…]

**Narrow Band Spectrum** is a limited range of wavelengths (nm) concentric to a dominant peak wavelength in the visible spectrum. The limited range of wavelength shall be within 20 nm on either side of the peak wavelength at 50 percent of the peak wavelength's relative spectral power, and within 75 nm on either side of the peak wavelength at 10 percent of the peak wavelength's relative spectral power.

[…]

**Solid State Lighting (SSL)** is a family of light sources that includes: semiconductor light emitting diodes (LEDs); and organic light emitting diodes (OLEDs).

**Driver,** when used in relation to solid state lighting, is a device that uses semiconductors to control and supply dc power for LED starting and operation.

[…]

**CHANGE SIGNIFICANCE:** Compact Fluorescent Lamp – The purpose of the change to this definition is to align with the definition in the Title 20 Appliance Efficiency Regulations. This change is necessary to create consistency between applicable regulations.

Lamp – The purpose of the change to this definition is to provide a clearer distinction between types of lighting. This change clarifies without materially altering the requirements of the Energy Code.

LED Retrofit Kit – The purpose of adding this definition is to provide clarification for a class of products that exist between removable lamps and fully integrated luminaires. These products are becoming increasingly more common, and defining this term is necessary to provide clear direction to manufacturers and installers of these products regarding the applicability of the requirements of the Energy Code.

Non-integrated LED lamp – The purpose of the change to this definition is to update its verbiage consistent with a general update to the latest version of ANSI/IES RP-16. This change is necessary to ensure consistency with current ANSI and IES lighting standards.

Integrated LED lamp – The purpose of the change to this definition is to update its verbiage consistent with a general update to the latest version of ANSI/IES RP-16. This change is necessary to ensure consistency with current ANSI and IES lighting standards.

Narrow Band Spectrum – The purpose of adding this definition is to recognize a specific class of lighting products with distinct features. This change is necessary to facilitate consideration of requirements that account for, or are tailored to, this specific subset of lighting products.

Ornamental Lighting – The purpose of the change to this definition is to change a wattage value consistent with proposed revisions to later

section language that propose wattage values consistent with typical LED performance.

Solid State Lighting (SSL) – The purpose of adding this definition is to clarify that solid state lighting includes both LEDs and OLEDs, and is not limited solely to LED lighting. This change clarifies without materially altering the requirements of the Energy Code.

Driver – The purpose of adding this definition is to specify the functions of circuitry that define it as a driver and separate it from other functions that the same circuitry may also perform. This change is necessary as there is not always a clear physical break or boundary between a driver and other circuitry.

*Getty Images*

LED Retrofit Kit – An LED retrofit kit is a solid state lighting product intended to replace existing light sources and systems in previously installed luminaires that already comply with safety standards, as defined in Section 100.1(b) of the 2019 Energy Code.

# 100.1(b)

## Definitions – Low-rise Residential Building

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** The term "habitable" was added to the language related to R-2 multifamily buildings under the definition of a "low-rise residential building" for clarity and consistency.

**2019 CODE:**

**LOW-RISE RESIDENTIAL BUILDING** is a building, other than a hotel/motel, that is Occupancy Group:

R-2, ~~multi-family~~multifamily, with three habitable stories or less; or

R-3, single family; or

U-building, located on a residential site.

**CHANGE SIGNIFICANCE:** The purpose of the changes to this definition is to correct punctuation and to add the word "habitable" for consistency with the definition of a "high-rise residential building." This change clarifies without materially altering the requirements of the Energy Code.

Getty Images

High-Rise Residential Buildings – Multifamily buildings of Occupancy Group R-2 (as defined in the *California Building Code*) with 4 or more habitable stories are defined as high-rise residential buildings.

# 100.1(b)

## Definitions – Occupancy

**CHANGE TYPE:** Addition and Clarification

**CHANGE SUMMARY:** Definitions related to occupancy were added, and occupiable space was altered for clarity.

**2019 CODE:**

**OCCUPANCY** is the purpose for which a building or part thereof is used or intended to be used.

**OCCUPANCY, HUMAN** is any occupancy that is intended primarily for human activities.

**OCCUPANCY GROUP** is a classification of occupancy defined in Chapter 3 of the CBC (Title 24, Part 2).

**OCCUPANCY TYPE** is a description of occupancy than is more specific than occupancy group and that relates to determining the amount of lighting, ventilation, or other services needed for that portion of the building.

**OCCUPIABLE SPACE** is any enclosed space that is~~inside the pressure boundary and~~ intended for human ~~activities~~occupancy, including~~, but not limited to,~~ all habitable spaces as well as~~,~~ bathrooms, toilets, closets, halls, storage and utility areas, ~~and~~ laundry areas, and similar areas.~~.~~ (See also "habitable space".)

**CHANGE SIGNIFICANCE:** Occupancy: Occupancy Human, Occupancy Group, Occupancy Type – The purpose of adding these definitions is to ensure that the terms that use the word "occupancy" have a consistent meaning where found in the Energy Code, that there is internal consistency among these terms, and that their meaning is also consistent with their use in the other Parts of Title 24. This change is necessary to eliminate a risk of ambiguity or inconsistency in either the use or meaning of these terms.

Occupiable Space – The purpose of the change to this definition is to harmonize it with the definitions for human occupancy and habitable space, and to more clearly express the distinction between "occupiable" and "habitable" space. This change clarifies without materially altering the requirements of the Energy Code.

# 100.1(b)

## Definitions – Overhangs

**CHANGE TYPE:** Modification

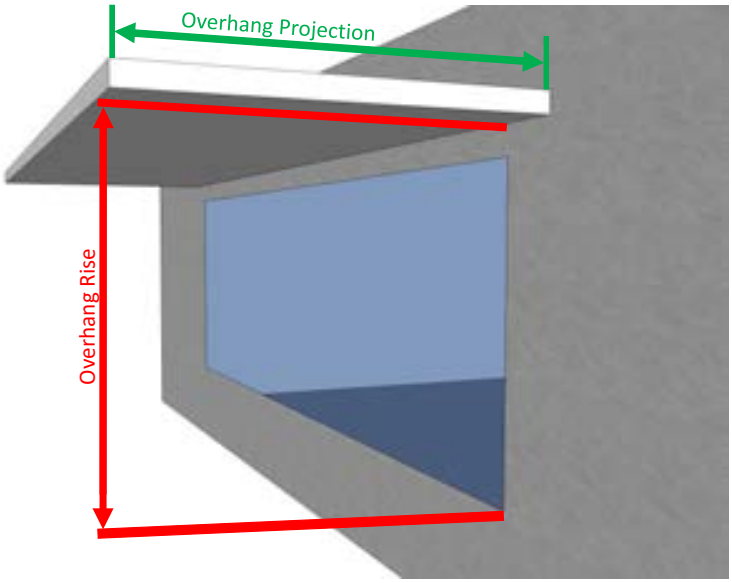
**CHANGE SUMMARY:** Terms related to overhangs were renamed, and their definitions were altered for clarity.

**2019 CODE:**

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

**OVERHANG RISE** is the vertical distance between the projected edge of an overhang and the sill of the vertical fenestration below it.

**CHANGE SIGNIFICANCE:** The term "overhang offset" has been changed to "overhang rise." The purpose of changing this term is to include a key term consistent with the clarification of automatic daylighting control requirements for the areas adjacent to vertical glazing below an overhang. This change clarifies without materially altering the requirements of the Energy Code.




Overhang Rise – The "overhang rise" is depicted by the red arrow. It is the vertical distance between the projected edge of an overhang and the window sill below. Source: California Energy Commission

# 100.1(b)

## Definitions – Proposed Design Building

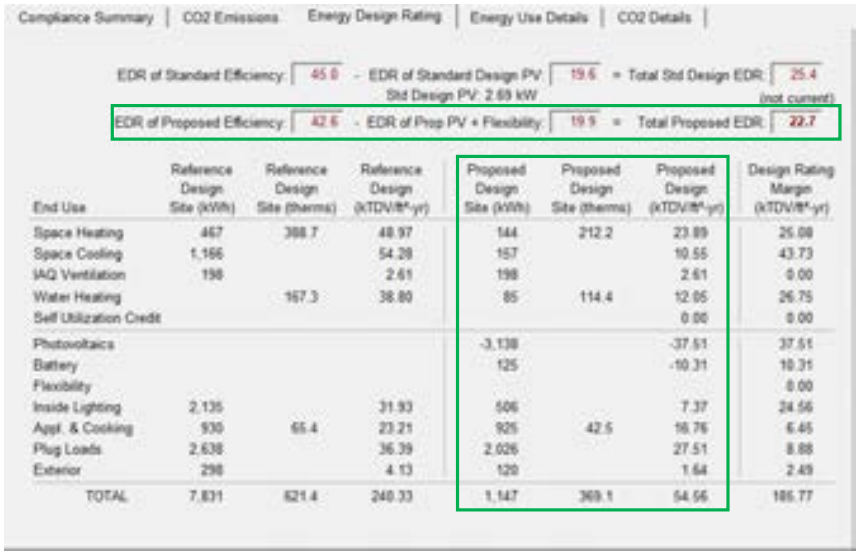
**CHANGE TYPE:** Modification and Clarification

**CHANGE SUMMARY:** The term "proposed design building energy use" was modified to remove "energy use," and the definition was simplified for clarity.

**2019 CODE:**

**PROPOSED DESIGN BUILDING ~~ENERGY USE~~** is a building that is simulated by Commission-approved compliance software to determine the energy consumption resulting from all of the characteristics and energy consuming features that are actually proposed for a building, as specified by 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.

**CHANGE SIGNIFICANCE:** The purpose of the change to this definition is to rename the term and make the definition clearer and more straightforward while also shortening the defined phrase. This change clarifies without materially altering the requirements of the Energy Code.

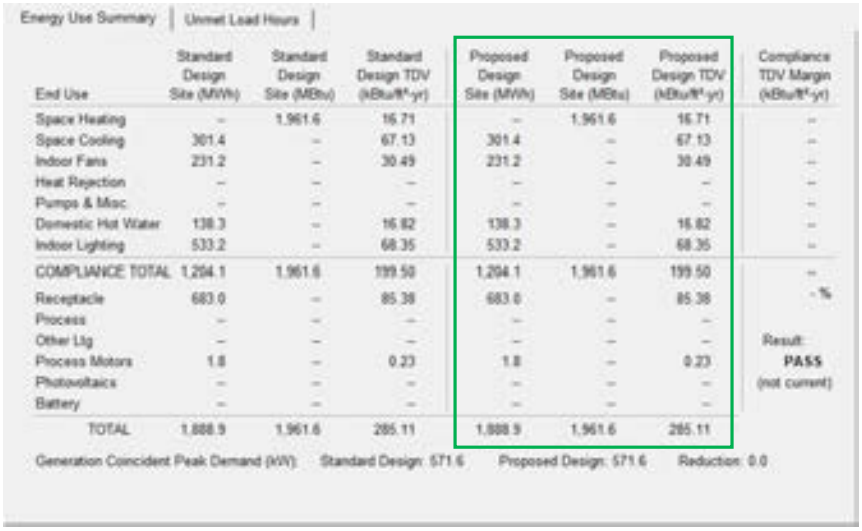


Compliance Summary | CO2 Emissions | Energy Design Rating | Energy Use Details | CO2 Details

EDR of Standard Efficiency: 45.0 - EDR of Standard Design PV: 19.6 = Total Std Design EDR: 25.4
Std Design PV: 2.69 kW (not current)
EDR of Proposed Efficiency: 42.6 - EDR of Prop PV + Flexibility: 19.9 = Total Proposed EDR: 22.7

| End Use | Reference Design Site (kWh) | Reference Design Site (therms) | Reference Design (kTDV/ft²-yr) | Proposed Design Site (kWh) | Proposed Design Site (therms) | Proposed Design (kTDV/ft²-yr) | Design Rating Margin (kTDV/ft²-yr) |
|---|---|---|---|---|---|---|---|
| Space Heating | 467 | 388.7 | 48.97 | 144 | 212.2 | 23.89 | 25.08 |
| Space Cooling | 1,166 | | 54.28 | 157 | | 10.55 | 43.73 |
| IAQ Ventilation | 198 | | 2.61 | 198 | | 2.61 | 0.00 |
| Water Heating | | 167.3 | 38.80 | 85 | 114.4 | 12.05 | 26.75 |
| Self Utilization Credit | | | | | | 0.00 | 0.00 |
| Photovoltaics | | | | -3,138 | | -37.51 | 37.51 |
| Battery | | | | 125 | | -10.31 | 10.31 |
| Flexibility | | | | | | | 0.00 |
| Inside Lighting | 2,135 | | 31.93 | 506 | | 7.37 | 24.56 |
| Appl. & Cooking | 930 | 65.4 | 23.21 | 925 | 42.5 | 16.76 | 6.45 |
| Plug Loads | 2,638 | | 36.39 | 2,026 | | 27.51 | 8.88 |
| Exterior | 298 | | 4.13 | 120 | | 1.64 | 2.49 |
| TOTAL | 7,831 | 621.4 | 240.33 | 1,147 | 369.1 | 54.56 | 185.77 |

Residential Proposed Design – Outlined in green, the proposed design shows the energy use of the residential building as designed.
Source: California Energy Commission, CBECC-Res Computer Modeling Program



Energy Use Summary | Unmet Load Hours

| End Use | Standard Design Site (MWh) | Standard Design Site (MBtu) | Standard Design TDV (kBtu/ft²-yr) | Proposed Design Site (MWh) | Proposed Design Site (MBtu) | Proposed Design TDV (kBtu/ft²-yr) | Compliance TDV Margin (kBtu/ft²-yr) |
|---|---|---|---|---|---|---|---|
| Space Heating | – | 1,961.6 | 16.71 | – | 1,961.6 | 16.71 | – |
| Space Cooling | 301.4 | – | 67.13 | 301.4 | – | 67.13 | – |
| Indoor Fans | 231.2 | – | 30.49 | 231.2 | – | 30.49 | – |
| Heat Rejection | – | – | – | – | – | – | – |
| Pumps & Misc | – | – | – | – | – | – | – |
| Domestic Hot Water | 138.3 | – | 16.82 | 138.3 | – | 16.82 | – |
| Indoor Lighting | 533.2 | – | 68.35 | 533.2 | – | 68.35 | – |
| COMPLIANCE TOTAL | 1,204.1 | 1,961.6 | 199.50 | 1,204.1 | 1,961.6 | 199.50 | – |
| Receptacle | 683.0 | – | 85.38 | 683.0 | – | 85.38 | - % |
| Process | – | – | – | – | – | – | |
| Other Ltg | – | – | – | – | – | – | Result: |
| Process Motors | 1.8 | – | 0.23 | 1.8 | – | 0.23 | PASS |
| Photovoltaics | – | – | – | – | – | – | (not current) |
| Battery | – | – | – | – | – | – | |
| TOTAL | 1,888.9 | 1,961.6 | 285.11 | 1,888.9 | 1,961.6 | 285.11 | |

Generation Coincident Peak Demand (kW): Standard Design: 571.6 Proposed Design: 571.6 Reduction: 0.0

Nonresidential Proposed Design – Outlined in green, the proposed design shows the energy use of the nonresidential building as designed.
Source: California Energy Commission, CBECC-Com Computer Modeling Program

# 100.1(b)

## Definitions – Daylit Zones

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Sidelit and skylit daylit zone definitions were moved from Section 130.1(d) to the definitions section, Section 100.1(b) of the Energy Code.

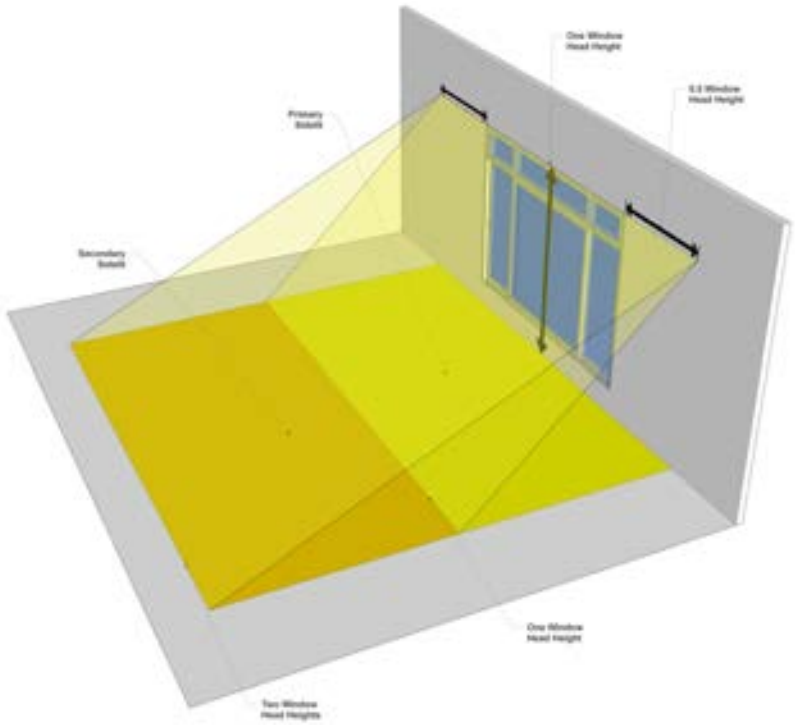
**2019 CODE:**

**SIDELIT DAYLIT ZONE, PRIMARY** is the area in plan view 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.

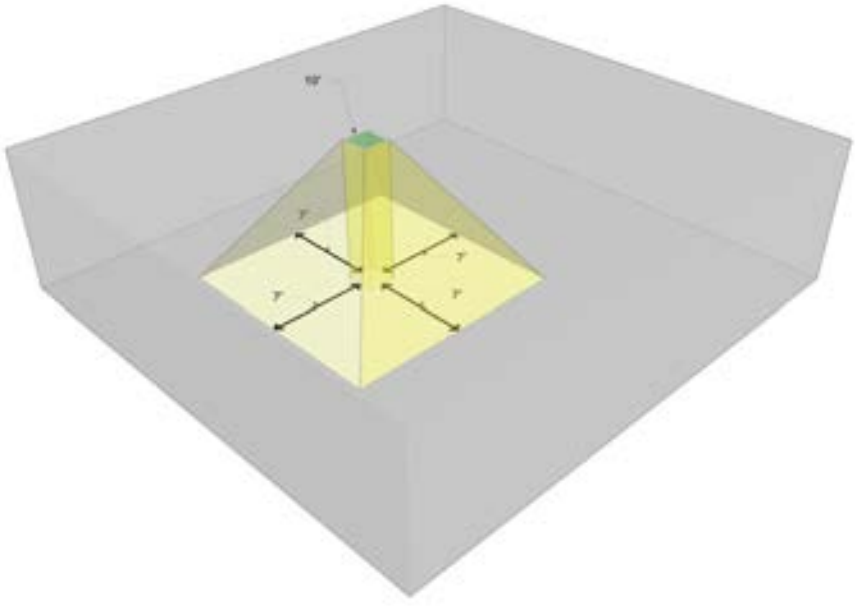
**SIDELIT DAYLIT ZONE, SECONDARY** is the area in plan view directly adjacent to each vertical glazing, two window head heights deep into the area, and window width plus 0.5 times window head height wide on each side of the rough opening of the window, minus any area on a plan beyond a permanent obstruction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

**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 one-half of the distance from the floor to the bottom of the skylight. The bottom of the skylight is measured from the bottom of the skylight well for skylights having wells, or the bottom of the skylight if no skylight well exists. For the purpose of determining the skylit daylit zone, the geometric shape of the skylit daylit zone shall be identical to the plan view geometric shape of the rough opening of the skylight; for example, for a rectangular skylight the skylit daylit zone plan area shall be rectangular, and for a circular skylight the skylit daylit zone plan area shall be circular. For skylight located in an atrium, the skylit daylit zone shall include the floor area directly under the atrium, and the area of the top floor that is directly under the skylight, plus 0.7 times the average ceiling height of the top floor, 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 one-half of the distance from the top floor to the bottom of the skylight.

**CHANGE SIGNIFICANCE:** The purpose of these changes is to move definitions previously located in Section 130.1(d) into the definition section, Section 100.1(b), consistent with the rest of the Energy Code. These changes do not materially alter the requirements of the Energy Code.



Sidelit Daylit Zones – The sidelit daylit zones extend one and two window head heights into the room, and their width is the width of the window plus ½ the window head height in each direction.
Source: California Energy Commission



Skylit Daylit Zones – Skylit daylit zones are determined by projecting the skylight to the floor, and then projecting that pattern in each direction a length of 0.7 times the ceiling height. In this example, the ceiling height is 10 feet, and the pattern is extended 7 feet in all directions.
Source: California Energy Commission

# 100.1(b)

## Definitions – Photovoltaic System

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** The 2019 Energy Code has added requirements for solar electric generation systems, or photovoltaic (PV) systems, and these terms were defined for clarity.

**2019 CODE:**

**SOLAR ELECTRIC GENERATION SYSTEM** or **PHOTOVOLTAIC SYSTEM** is the complete set of all components for converting sunlight into electricity through the photovoltaic process, including the array of panels, inverter(s) and the balance of system components required to enable the system to effectively deliver power to reduce a building's consumption of electricity from the utility grid.

**CHANGE SIGNIFICANCE:** The purpose of adding this definition is to clearly state the scope of equipment referred to when these terms are used. This addition is necessary to ensure clarity and specificity for the new PV system requirements for newly constructed low-rise residential buildings.

Getty Images

Residential Home with a PV System Installed – The 2019 Energy Code now requires PV systems to be installed on newly constructed low-rise residential buildings. More on this can be found in Section 150.1(c)14 of the Energy Code.

# 100.1(b)

## Definitions – Standard Design Building

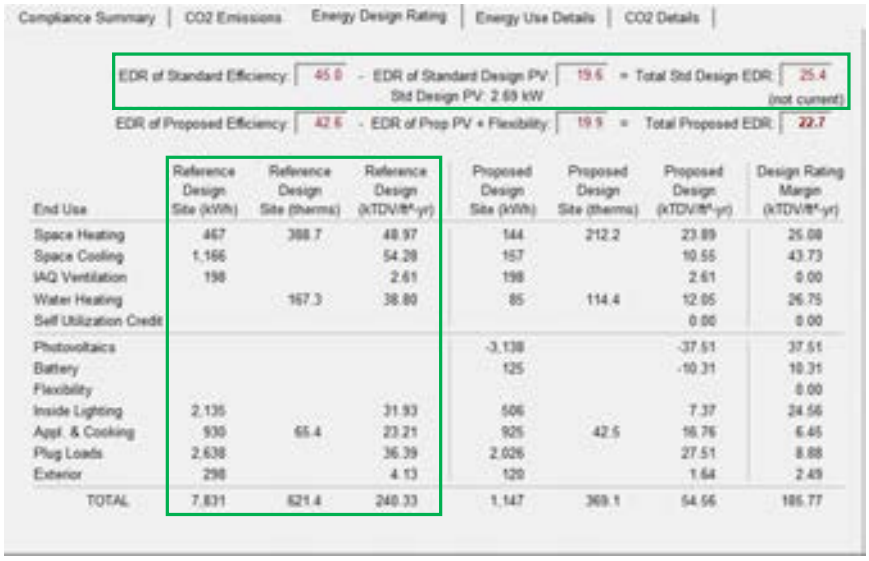
**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** The definition of "standard design building" has been updated for clarity.

**2019 CODE:**

**STANDARD DESIGN BUILDING** is a building that is automatically simulated by Commission-approved compliance software to establish the Energy Budget that is the maximum energy consumption allowed by a Proposed Design Building to comply ~~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) Reference Manual~~. The Standard Design building is simulated using the same location and having the same characteristics of the Proposed Design building, but assuming minimal compliance with the mandatory and prescriptive requirements that are applicable to the proposed building, as specified by the Alternative Calculation Methods Approval Manual.

**CHANGE SIGNIFICANCE:** The purpose of the change to this definition is to harmonize its language with clarifying changes proposed for the definition of "proposed design building." This change clarifies without materially altering the requirements of the Energy Code.




| End Use | Reference Design Site (kWh) | Reference Design Site (therms) | Reference Design (kTDV/ft²-yr) | Proposed Design Site (kWh) | Proposed Design Site (therms) | Proposed Design (kTDV/ft²-yr) | Design Rating Margin (kTDV/ft²-yr) |
|---|---|---|---|---|---|---|---|
| Space Heating | 467 | 388.7 | 48.97 | 144 | 212.2 | 23.89 | 25.08 |
| Space Cooling | 1,166 | | 54.28 | 157 | | 10.55 | 43.73 |
| IAQ Ventilation | 198 | | 2.61 | 198 | | 2.61 | 0.00 |
| Water Heating | | 167.3 | 38.80 | 85 | 114.4 | 12.05 | 26.75 |
| Self Utilization Credit | | | | | | 0.00 | 0.00 |
| Photovoltaics | | | | -3,138 | | -37.51 | 37.51 |
| Battery | | | | 125 | | -10.31 | 10.31 |
| Flexibility | | | | | | | 0.00 |
| Inside Lighting | 2,135 | | 31.93 | 506 | | 7.37 | 24.56 |
| Appl. & Cooking | 930 | 65.4 | 23.21 | 925 | 42.5 | 16.76 | 6.45 |
| Plug Loads | 2,638 | | 36.39 | 2,026 | | 27.51 | 8.88 |
| Exterior | 298 | | 4.13 | 120 | | 1.64 | 2.49 |
| TOTAL | 7,831 | 621.4 | 240.33 | 1,147 | 369.1 | 54.56 | 185.77 |

Residential Standard Design – The standard design in green shows the energy consumption that this low-rise residential building will be measured against
Source: California Energy Commission, CBECC-Res Computer Modeling Program

Energy Use Summary | Unmet Load Hours

| End Use | Standard Design Site (MWh) | Standard Design Site (MBtu) | Standard Design TDV (kBtu/ft²-yr) | Proposed Design Site (MWh) | Proposed Design Site (MBtu) | Proposed Design TDV (kBtu/ft²-yr) | Compliance TDV Margin (kBtu/ft²-yr) |
|---|---|---|---|---|---|---|---|
| Space Heating | – | 1,961.6 | 16.71 | – | 1,961.6 | 16.71 | – |
| Space Cooling | 301.4 | – | 67.13 | 301.4 | – | 67.13 | – |
| Indoor Fans | 231.2 | – | 30.49 | 231.2 | – | 30.49 | – |
| Heat Rejection | – | – | – | – | – | – | – |
| Pumps & Misc. | – | – | – | – | – | – | – |
| Domestic Hot Water | 138.3 | – | 16.82 | 138.3 | – | 16.82 | – |
| Indoor Lighting | 533.2 | – | 68.35 | 533.2 | – | 68.35 | – |
| COMPLIANCE TOTAL | 1,204.1 | 1,961.6 | 199.50 | 1,204.1 | 1,961.6 | 199.50 | – |
| Receptacle | 683.0 | – | 85.38 | 683.0 | – | 85.38 | - % |
| Process | – | – | – | – | – | – | |
| Other Ltg | – | – | – | – | – | – | Result: |
| Process Motors | 1.8 | – | 0.23 | 1.8 | – | 0.23 | PASS |
| Photovoltaics | – | – | – | – | – | – | (not current) |
| Battery | – | – | – | – | – | – | |
| TOTAL | 1,888.9 | 1,961.6 | 285.11 | 1,888.9 | 1,961.6 | 285.11 | |

Generation Coincident Peak Demand (kW): Standard Design: 571.6 Proposed Design: 571.6 Reduction: 0.0

Nonresidential Standard Design – The standard design in green shows the energy consumption that this nonresidential building will be measured against.
Source: California Energy Commission, CBECC-Com Computer Modeling Program

PART 2

# All Occupancies—Mandatory Requirements for the Manufacture, Construction and Installation of Systems, Equipment, and Building Components

## Subchapter 2

Subchapter 2 identifies mandatory requirements that are applicable to all buildings regulated by the Energy Code (low-rise residential, high-rise residential, nonresidential, and hotel/motel buildings). This subchapter spans from Section 110.0 through 110.12. Requirements listed in these sections are mandatory and cannot be traded away via the performance approach. ■

**110.3**

**Mandatory Requirements for Service Water Heating Systems and Equipment**

**110.3(c)**

**Installation**

**110.5**

**Natural Gas Central Furnaces, Cooking Equipment, Pool and Spa Heaters, and Fireplaces: Pilot Lights Prohibited**

**110.6**

**Fenestration Products and Exterior Doors**

**110.6(a)**

**Certification of Fenestration Products and Exterior Doors other than Field-Fabricated**

**110.9**

**Mandatory Requirements for Lighting Controls**

**110.9(a)**

**General**

**110.9(b)**

**All Lighting Controls**

**110.9(b)1**

**Time Switch Lighting Controls**

**110.9(b)2**

**Daylighting Controls**

**110.9(b)3**

Dimmers

**110.9(b)4**

Occupant Sensing Controls

**110.9(B)5**

Part-Night Outdoor Lighting Controls

**110.9(b)6 and 7**

Sensors Used to Detect Occupants; Indicator Lights

**110.9(c)**

Track Lighting Integral Current Limiter

**110.9(d)**

Track Lighting Supplementary Overcurrent Protection Panel

**110.9(e) and (f)**

JA8 High Efficacy Light Sources, and Ballasts for Residential Recessed Luminaires

**110.10**

Mandatory Requirements for Solar Ready Buildings

**110.10(a)**

Covered Occupancies

**110.12**

Mandatory Requirements for Demand Management

**110.12(a)**

Covered Occupancies

# 110.3

## Mandatory Requirements for Service Water Heating Systems and Equipment

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** A reference to the portion of the plumbing code that applies to healthcare facilities has been added to this section.

**2019 CODE:**

(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 3, Chapter 50 of the ASHRAE Handbook, HVAC Applications Volume or Table 613.1 of the *California Plumbing Code* for healthcare facilities.

   **EXCEPTION to Section 110.3(a)1:** Residential occupancies.

**CHANGE SIGNIFICANCE:** Healthcare facilities are included in the scope of the Energy Code for the first time. To accommodate their unique needs for health and safety, they are exempt from some energy code provisions, or have separate or alternative requirements.

The addition to this section is an acknowledgement that healthcare facilities need higher water temperatures than other nonresidential buildings for certain applications. They must use the highest acceptable temperature settings specified in Table 613.1 of the *California Plumbing Code* when necessary. Alternatively, they may realize additional energy savings with temperature control settings in Table 3 in Chapter 50 of the ASHRAE HVAC Applications Handbook, depending on the service application.

The temperature control requirements for all other nonresidential service water heating systems continue to be specified in the 2015 ASHRAE HVAC Applications Handbook.

**TABLE 613.1 of the California Plumbing Code [OSHPD 1, 1R, 2, 3, 4 & 5] Hot Water Use**

| | CLINICAL | DIETARY[1] | LAUNDRY[2] |
|---|---|---|---|
| *Liter/Hour/Bed* | *11.9* | *7.2* | *7.6* |
| *Gallons/Hour/Bed* | *3* | *2* | *2* |
| *Temperature °C* | *41-49.0* | *49.0* | *71.0* |
| *Temperature °F* | *105-120.0* | *120* | *160.0* |

*1 Rinse water temperature at automatic dishwashing equipment and pot sinks shall be 180°F (82°C).*

***Exception:** The rinse water supply to pot rinse sinks may be deleted if a method of chemical disinfection using a three-compartment sink is proposed.*

*2 The required temperature of 160°F (71°C) in the laundry is that measure in the washing machine and shall be supplied so that the temperature may be maintained over the entire wash and rinse period.*

***Exception:*** *A lower water temperature of 140°F (60°C) may be utilized, provided linens are subsequently passed through a tumbler dryer at 180°F (82°C) or a flatwork ironer at 300°F (149°C).*

# 110.3(c)
## Installation

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Exceptions were added for service water heating systems in healthcare facilities.

**2019 CODE:**

(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.

   **EXCEPTION to Section 110.3(c)1:** Systems covered by *California Plumbing Code* Section 613.0 shall instead follow the requirements of that section.

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 110.3(c)2:** Systems serving healthcare facilities.

3. ~~**Temperature controls for public lavatories.** The controls shall limit the outlet temperature at the fixtures to 110°F.~~

   […]

6~~5~~. **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, per the statutory requirement of California Public Resources Code Section 25498.

   **EXCEPTION to Section 110.3(c)6~~5~~:** Buildings for which the state architect determines that service water heating from site solar energy or recovered energy is economically or physically infeasible. […]

**CHANGE SIGNIFICANCE:** The service water heating system installation requirements in Section 110.3(c) are mandatory for residential and nonresidential buildings, with some exceptions for healthcare facilities. The system or equipment must comply with measures for outlet temperature controls, hot water distribution system controls, insulation, recirculation loops, State of California government buildings, and isolation valves.

Now that healthcare facilities are within the scope of the Energy Code, Section 110.3(c)1 has a new exception to the requirements for outlet temperature controls to harmonize with the California's Plumbing Code. Service water heating systems covered by *California Plumbing Code* Section 613.0 must instead follow those requirements. This change prevents a conflict between the Plumbing Code and the Energy Code.

The exception to Section 110.3(c)2 exempts licensed healthcare facilities from requirements for water distribution systems controls. Service hot water systems with circulating pumps or with electrical heat trace systems must be capable of automatically turning off the system. This exception is necessary because this section has the potential to interfere with the primary health and safety responsibilities of healthcare facilities. Infection control requires sustained higher temperatures in distribution lines than in other buildings. In addition, the measure may not be cost effective for healthcare facilities because they operate continuously. In future code cycles, more detailed analysis may result in this exception's revision or removal.

Section 110.3(c)3 covering temperature controls in public lavatories has been removed from the Energy Code. The *California Plumbing Code* specifies the minimum output temperature for public lavatories, and this section duplicated the requirement. During the 2019 Energy Code rulemaking process, the initial draft regulations proposed a revision to harmonize the water temperature specifications with *California Plumbing Code* Section 407.3, but in the final version adopted by the Energy Commission, all of Section 110.3(c)3 was deleted to increase clarity, and to streamline the code. The remaining subsections have been re-numbered, so the 2019 version of Section 110.3(c)3 now addresses insulation.

The minor change to Section 110.3(c)5 is a clarification. Newly constructed State of California government buildings have unique requirements designed to meet energy efficiency goals. At least 60% of the energy needed for service water heating systems must come from site solar energy or recovered energy. New language has been added that references the California Public Resources Code to inform the reader that Section 110.3(c)5 is statutory in nature.

# 110.5

## Natural Gas Central Furnaces, Cooking Equipment, Pool and Spa Heaters, and Fireplaces: Pilot Lights Prohibited

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Continuously burning pilot lights are now prohibited for indoor and outdoor fireplaces serving buildings covered by the Energy Code.

**2019 CODE:**

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.

(e) Indoor and outdoor fireplaces.

[…]

**CHANGE SIGNIFICANCE:** Fireplaces have been added to the list of equipment that cannot have continuously burning pilot lights. Previously, only indoor fireplaces installed in low-rise residential buildings were regulated in this way. This limitation has been expanded to apply to all buildings covered by the Energy Code. This mandatory measure reduces uneconomic and inefficient energy consumption. Note that intermittent pilot lights, meaning pilot lights that are on while the fireplace is in use and off while the fireplace is not in use, are allowed by the Energy Code.

# 110.6(a)

## Certification of Fenestration Products and Exterior Door other than Field-Fabricated

**TYPE:** Modification and Clarification

**CHANGE SUMMARY:** Exterior doors that are not field fabricated now must meet *U*-factor and labeling requirements, and the threshold for using an exception to calculate default *U*-factor, Solar Heat Gain Coefficient (SHGC), and Visible Transmittance (VT) values, was lowered.

**2019 CODE:**

(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/ft$^2$ of window area, 0.3 cfm/ft$^2$ of door area for residential doors, 0.3 cfm/ft$^2$ of door area for nonresidential single doors (swinging and sliding), and 1.0 cfm/ft$^2$ 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/ft$^2$), incorporated herein by reference.

   **NOTES TO SECTION 110.6(a)1:**

   Pet doors must meet 0.3 cfm/ft$^2$ when tested according to ASTM E283 at 75 pascals (or 1.57 pounds/ft$^2$). AAMA/WDMA/CSA 101/I.S.2/A440-2011 specification is equivalent to ASTM E283 at a pressure differential of 75 pascals (or 1.57 pounds/ft$^2$) and satisfies the air leakage certification requirements of this section.

   **EXCEPTION to Section 110.6(a)1:** Field-fabricated fenestration and field-fabricated exterior doors.

2. **U-factor.** The fenestration product and exterior door'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.

   **EXCEPTION 1 to Section 110.6(a)2:** If the fenestration product is a skylight or a vertical site-built fenestration product in a building covered by the nonresidential standards with less than ~~1,000~~200 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 of any area replacement of glass in a skylight product or in a vertical site-built fenestration product, 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 fenestration product's SHGC shall be rated in accordance with NFRC 200, or use the applicable default SHGC set forth in TABLE 110.6-B.

**EXCEPTION 1 to Section 110.6(a)3:** If the fenestration product is a skylight or a vertical site-built fenestration product in a building covered by the nonresidential standards with less than ~~1,000~~200 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 of any area replacement of glass in a skylight product or in a vertical site-built fenestration product, in a building covered by the nonresidential standards, the default SHGC may be calculated as set forth in Reference Nonresidential Appendix NA6.

4. **Visible Transmittance (VT).** The fenestration product's VT shall be rated in accordance with NFRC 200 or ASTM E972, for tubular ~~skylights~~ daylighting devices VT shall be rated using NFRC 203.

   **EXCEPTION 1 to Section 110.6(a)4:** If the fenestration product is a skylight or a vertical site-built fenestration product in a building covered by the nonresidential standards with less than ~~1,000~~200 square feet of site-built fenestration, the default VT may be calculated as set forth in Reference Nonresidential Appendix NA6.

   **EXCEPTION 2 to Section 110.6(a)4:** If the fenestration product is an alteration consisting of any area; replacement of glass in a skylight product or in a vertical site-built fenestration product in a building covered by the nonresidential standards, the default VT may be calculated as set forth in Reference Nonresidential Appendix NA6.

5. **Labeling.** Fenestration products and exterior doors shall:

   A. Have a temporary label for manufactured fenestration products and exterior doors or a label certificate when the Component Modeling Approach (CMA) is used and for site-built fenestration meeting the requirements of Section 10-111(a)1. The temporary label shall not be removed before inspection by the enforcement agency; and

   B. Have a permanent label or a label certificate when the Component Modeling Approach (CMA) is used and for site-built fenestration meeting the requirements of Section 10-111(a)2 if the product is rated using NFRC procedures.

[…]

**CHANGE SIGNIFICANCE:** Installed fenestration products that are not field-fabricated must be certified to the National Fenestration Rating Council (NFRC) showing they comply with the Energy Code. They must meet *U*-factor, SHGC, air leakage, VT and labeling specifications. Certified products meet or exceed the applicable requirements of Section 110.6(a).

The labeling requirements make it easier to identify certified products. The product manufacturer is responsible for the certification label, or they can an NFRC label.

In Section 110.6(a)2 and 5, the term "exterior doors" has been added to clarify that these products must comply with *U*-factor specifications and labeling requirements. This is stated at the beginning of subsection (a), but was not restated in (a)2 and (a)5 in previous code cycles.

In Section 110.6(a)2, 3, and 4, the allowable square footage to use the exception square footage thresholds has been reduced. The exceptions now apply for nonresidential buildings with less than 200 square feet of site-built fenestration. The area threshold was formerly 1,000 square feet. Site-built fenestration not exceeding this new limit can use the calculations found in Reference Nonresidential Appendix NA6 to determine alternate default *U*-factor, SHGC, and VT values.

Section 110.6(a)4 specifies visual transmittance allowances. The 2019 Energy Code now uses the term "tubular daylighting device" to describe the devices subject to the VT specifications. Formerly called "tubular skylight," the new term more accurately characterizes these devices, given the variety of daylighting products available on the market. The change also resolves a conflict with the definition of the term "skylight."


Sample NFRC Label
Source: National Fenestration Rating Council

# 110.9(a)

## Mandatory Requirements for Lighting Controls; General

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Requirements for different types of lighting control components, systems, and light sources have been consolidated, and language was relocated.

**2019 CODE:**

(a) **All lighting control devices and systems~~,~~ ~~ballasts~~, and ~~luminaires~~ all light sources** 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~~ light source 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 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.~~

**CHANGE SIGNIFICANCE:** Advances in lighting control technology helped simplify Section 110.9. Measures now apply to "lighting controls" and "light sources" instead of the various control system components and systems that were specified in the 2016 Energy Code.

Another simplification is the removal of Section 110.9(a)3. It is no longer necessary for manufacturers to certify lighting controls to the Title 20 Modernized Appliance Efficiency Database System (MAEDbS). Lighting control technology and installation best practices have improved, thus diminishing the value of manufacturer certification. For example, nonresidential lighting controls undergo acceptance testing to confirm correct installation, configuration, and operation, while residential controls are digital devices that are increasingly reliable and user-friendly.

The lighting control measures in Section 110.9 continue to apply to indoor and outdoor signs. This has been clarified by adding Section 110.9 to the other mandatory measures for signs in Table 100.0-A.

# 110.9(b)1

## All Lighting Controls, Time Switch Lighting Controls

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Time-switch lighting controls will no longer require manufacturer certification, though devices must still comply with specified requirements which have been relocated from the Appliance Efficiency Regulations to this section.

**2019 CODE:**

**(b) All ~~Installed~~ Lighting Control<u>s</u>. ~~Systems~~** <u>Lighting controls</u> 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.** <u>All controls that provide time-switch functionality, including all automatic and astronomical time-switch controls, shall have program backup capabilities that prevent the loss of the device's schedule for at least 7 days, and the device's date and time for at least 72 hours if power is interrupted. In addition:</u>
   A. **~~Automatic~~ Time-Switch Controls** <u>installed in nonresidential buildings</u> shall ~~meet all requirements for Automatic Time Switch Control devices in the Title 20 Appliance Efficiency Regulations.~~
      <u>i. For each connected load, be capable of providing manual override to each connected load and of resuming normally scheduled operation after a manual override is initiated within 2 hours; and</u>
      <u>ii. Provide an automatic holiday shutoff feature that turns off all connected loads for at least 24 hours and then resumes normally scheduled operation.</u>
   B. **Astronomical Time-Switch Controls** shall<u>:</u> ~~meet all requirements for Astronomical Time-Switch Control devices in the Title 20 Appliance Efficiency Regulations.~~
      <u>i. Have sunrise and sunset prediction accuracy within plus-or-minus 15 minutes and timekeeping accuracy within 5 minutes per year;</u>
      <u>ii. Be capable of displaying date, current time, sunrise time, sunset time, and switching times for each step during programming;</u>
      <u>iii. Be capable of automatically adjusting for daylight savings time; and</u>
      <u>iv. Have the ability to independently offset the on and off for each channel by at least 90 minutes before and after sunrise or sunset.</u>
   C. **MultiLevel ~~Astronomical~~ Time-Switch Controls,** ~~in addition to meeting all of the requirements for Astronomical Time-Switch Controls~~, shall include at least ~~2~~two separately programmable steps per zone.

D. **~~Outdoor Astronomical~~ Time-Switch Controls installed outdoors,** ~~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 at least one specific time of day.

**CHANGE SIGNIFICANCE:** The purpose of the changes in this section are to relocate lighting control device specifications present in the Appliance Efficiency Regulations to this section of the Energy Code. Previously, the Energy Code referred to the Appliance Efficiency Regulations for lighting control device requirements. This was done to facilitate manufacturer product certification. However, the Appliance Efficiency Regulations can be updated outside of the Building Code's triennial cycle, causing inconsistencies with Section 110.9. Relocating this language back into Section 110.9 is necessary to prevent out-of-cycle changes to the requirements of the Energy Code, and to facilitate reconsideration of manufacturer certification requirements.

The time-switch lighting control requirements were relocated from the Appliance Efficiency Regulations to Section 110.9(b)1. There are no substantive changes to these requirements.

# 110.9(b)2

## All Lighting Controls, Daylighting Controls

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Daylighting controls no longer require manufacturer certification, however devices must still comply with specified requirements which have been relocated from the Appliance Efficiency Regulations to this section.

**2019 CODE:**

(b) **All ~~Installed~~ Lighting Controls. ~~Systems~~** Lighting controls 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).

[…]

**2. Daylighting Controls.** Controls that provide automatic daylighting functionality shall:

A. Automatically return to its most recent time delay settings within 60 minutes of the last received input when left in calibration mode;

B. Have a set point control that easily distinguishes settings to within 10 percent of full scale adjustment;

C. Provide a linear response within 5 percent accuracy over the range of illuminance measured by the light sensor; and

D. Be capable of being calibrated in a manner that the person initiating the calibration is remote from the sensor during calibration to avoid influencing calibration accuracy, for example by having a light sensor that is physically separated from where the calibration adjustments are made.

~~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.~~

**CHANGE SIGNIFICANCE:** The purpose of the changes in this section are to relocate lighting control device specifications present in the Appliance Efficiency Regulations to this section of the Energy Code. Previously, the Energy Code referred to the Appliance Efficiency Regulations for lighting control device requirements. This was done to facilitate manufacturer product certification. However, the Appliance Efficiency Regulations can be updated outside of the Building Code's triennial cycle, causing inconsistencies with Section 110.9. Relocating this language back into Section 110.9 is necessary to prevent out-of-cycle changes to the requirements of the Energy Code and to facilitate reconsideration of manufacturer certification requirements.

The daylighting control requirements were relocated from the Appliance Efficiency Regulations to Section 110.9(b)2. There are no substantive changes to these requirements.

# 110.9(b)3

## All Lighting Controls, Dimmers

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Dimmer controls no longer require manufacturer certification, however devices must still comply with specified requirements which have been relocated from the Appliance Efficiency Regulations to this section.

**2019 CODE:**

(b) **All ~~Installed~~ Lighting Control<u>s.</u> ~~Systems~~** <u>Lighting controls</u> 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).

[…]

3. **Dimmers.** ~~shall meet all requirements for Dimmer Control devices in the Title 20 Appliance Efficiency Regulations.~~<u>Controls that provide dimming functionality shall:</u>

   <u>A. Be capable of reducing lighting power consumption by a minimum of 65% when at its lowest setting;</u>

   <u>B. Provide reduced flicker operation, meaning that directly controlled light sources shall be provided electrical power such that the light output has an amplitude modulation of less than 30 percent for frequencies less than 200 Hz without causing premature lamp failure;</u>

   <u>C. Provide an off setting that produces a zero lumen output; and</u>

   <u>D. For wall box dimmers and associated switches designed for use in three way circuits, be capable of turning lights off, and on to the level set by the dimmer if the lights are off.</u>

**CHANGE SIGNIFICANCE:** The purpose of the changes in this section are to relocate lighting control device specifications present in the Appliance Efficiency Regulations to this section of the Energy Code. Previously, the Energy Code referred to the Appliance Efficiency Regulations for lighting control device requirements. This was done to facilitate manufacturer product certification. However, the Appliance Efficiency Regulations can be updated outside of the Building Code's triennial cycle, causing inconsistencies with Section 110.9. Relocating this language back into Section 110.9 is necessary to prevent out-of-cycle changes to the requirements of the Energy Code and to facilitate reconsideration of manufacturer certification requirements.

The dimmer control requirements previously contained within the Appliance Efficiency Regulations have been relocated to Section 110.9(b)3. There are no substantive changes to these requirements.

# 110.9(b)4

## All Lighting Controls, Occupant Sensing Controls

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Occupant sensing controls no longer require manufacturer certification, but these devices must still comply with specified requirements which have been relocated from the Appliance Efficiency Regulations to this section.

**2019 CODE:**

(b) **All ~~Installed~~ Lighting Controls.** ~~Systems~~ Lighting controls 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).

[…]

4. **Occupant Sensing Controls.**: Occupant sensing controls include occupant sensors, motion sensors, and vacancy sensors, including those with a Partial-ON or Partial-OFF function. Occupant sensing controls shall:

A. Be capable of automatically turning the controlled lights in the area either off or down no more than 20 minutes after the area has been vacated;

B. For manual-on controls, have a grace period of no less than 15 seconds and no more than 30 seconds to turn on lighting automatically after the sensor has timed out; and

C. Provide 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 that turns off the signal.

~~Occupant, Motion, and Vacancy Sensor Controls shall meet the following requirements:~~

~~A. **Occupant Sensors** shall meet all applicable requirements for Occupant Sensor Control devices in the Title 20 Appliance Efficiency Regulations.~~

~~B. **Motion Sensors** shall meet all applicable requirements for Motion Sensor Controls devices in the Title 20 Appliance Efficiency Regulations.~~

~~C. **Vacancy Sensors** shall meet all applicable requirements for Vacancy Sensor Controls devices in the Title 20 Appliance Efficiency Regulations.~~

~~D. **Partial-ON Sensors** shall meet all applicable requirements for partial on sensing devices in the Title 20 Appliance Efficiency Regulations.~~

~~E. **Partial-OFF Sensors** shall meet all applicable requirements for partial off sensing devices in the Title 20 Appliance Efficiency Regulations.~~

~~F. All Occupant Sensing Control types shall be programmed to turn OFF all or part of the lighting no longer than 20 minutes after the space is vacated of occupants, except as specified by Section 130.1(c)8.~~

**EXCEPTION to Section 110.9(b)4:** Occupant Sensing Control systems may consist of a combination of single or multilevel 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~~occupants from manual-on to automatic-on functionality.

**CHANGE SIGNIFICANCE:** The purpose of the changes in this section are to relocate lighting control device specifications present in Appliance Efficiency Regulations to this section of the Energy Code. Previously, the Energy Code referred to the Appliance Efficiency Regulations for lighting control device requirements. This was done to facilitate manufacturer product certification. However, the Appliance Efficiency Regulations can be updated outside of the Building Code's triennial cycle, causing inconsistencies with Section 110.9. Relocating this language back into Section 110.9 is necessary to prevent out-of-cycle changes to the requirements of the Energy Code and to facilitate reconsideration of manufacturer certification requirements.

The occupant sensing control requirements previously contained within the Appliance Efficiency Regulations have been relocated to Section 110.9(b)4. There are no substantive changes to these requirements.

# 110.9(b)5

## All Lighting Controls, Part-Night Outdoor Lighting Controls

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Clarifies functionality requirements for part-night outdoor lighting controls.

**2019 CODE:**

(b) **All ~~Installed~~ Lighting Control<u>s.</u> ~~Systems~~** <u>Lighting controls</u> 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).

[…]

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<u>,</u> ~~and timekeeping accuracy within five minutes per year~~<u>using both light sensing and time measurement;</u> and
   B. Have the ability to ~~setback~~ <u>reduce</u> or turn off ~~lighting~~ <u>outdoor luminaire power</u> at night as required in Section 130.2(c)<u>~~, by means of a programmable timeclock or motion sensing device~~</u>; and
   C. ~~When controlled with a timeclock, s~~<u>S</u>hall be ~~capable of being programmed~~<u>programmable</u> to ~~allow the setback~~<u>reduce</u> or ~~turning~~ <u>turn</u> off ~~of the lighting~~<u>outdoor luminaire power</u> ~~to occur from~~at any time ~~at night until any time in the morning~~, as determined by the user. <u>Time-based scheduling control is allowed to be relative to both sunset and sunrise, and to the midpoint between sunset and sunrise.</u>

**CHANGE SIGNIFICANCE:** Part-night outdoor lighting controls are defined in Section 100.1 as "… a light sensing and time-based lighting control device or system that is programmed to reduce or turn off the lighting power to an outdoor luminaire for a portion of the night." The changes to Section 110.9(b)5 clarify specific functionality requirements for part-night outdoor lighting controls.

Part-night outdoor lighting controls must have the following capabilities so that outdoor lighting can be reduced during scheduled periods:

- Sunrise and sunset prediction accuracy within +/- 15 minutes, using both light sensing and time measurement; and
- Reduce or turn off outdoor luminaire power at night as required in Section 130.2(c). Section 130.2(c) addresses functional requirements for installed controls, and includes exceptions for safety or local needs; and
- Reduce or turn off outdoor luminaire power at any time the user chooses. Time-based scheduling control is allowed to be relative to both sunset and sunrise, and to the midpoint between sunset and sunrise.

*Getty Images*

Parking Lot Lighting – This lighting must satisfy automatic shutoff and reduction of power requirements where applicable.

# 110.9(b)6 and 7

## All Lighting Controls, Sensors Used to Detect Occupants; Indicator Lights

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Controls no longer require manufacturer certification, but these devices must still comply with specified requirements which have been relocated and consolidated from the Appliance Efficiency Regulations to Section 110.9(b)6 and 110.9(b)7.

**2019 CODE:**

(b) **All ~~Installed~~ Lighting Control<u>s</u>. ~~Systems~~** <u>Lighting controls</u> 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).

[…]

<u>6. **Sensors used to detect occupants.** Sensors that are used by occupant sensing controls to detect occupants shall meet all of the following requirements:

A. Sensors shall not incorporate switches or mechanical devices that allow the sensor to be disabled without changing the settings of the control.

B. Sensors that utilize ultrasonic radiation for detection of occupants shall:

i. comply with 21 C.F.R. part 1002.12;

ii. not emit audible sound; and

iii. not emit ultrasound in excess of the decibel levels shown in Table 110.9-A measured no more than five feet from the source, on axis.

C. Sensors that utilize microwave radiation for detection of occupants shall:

i. comply with 47 C.F.R. parts 2 and 15; and

ii. 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.

7. **Indicator Lights.** Indicator lights integral to lighting controls shall consume no more than one watt of power per indicator light.

[…]</u>

**TABLE 110.9-A Ultrasound Maximum Decibel Values**

| Mid-frequency 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 |

**CHANGE SIGNIFICANCE:** The purpose of the changes in this section are to relocate lighting control device specifications present in the Appliance Efficiency Regulations to this section of the Energy Code. Previously, the Energy Code referred to the Appliance Efficiency Regulations for lighting control device requirements. This was done to facilitate manufacturer product certification. However, the Appliance Efficiency Regulations can be updated outside of the Building Code's triennial cycle, causing inconsistencies with Section 110.9. Relocating this language back into Section 110.9 is necessary to prevent out-of-cycle changes to the requirements of the Energy Code and to facilitate reconsideration of manufacturer certification requirements.

The occupant sensing control requirements previously contained within the Appliance Efficiency Regulations have been relocated to Section 110.9(b)6.

The indicator light requirements previously contained within the Appliance Efficiency Regulations have been relocated to Section 110.9(b)7. Section 110.9(b)7 applies to indicator lights that are integral to lighting controls. An individual indicator light can consume no more than one watt of power.

When it is difficult to verify that the device specifications comply with the Energy Code, the builder or installer should make the product documentation available to inspectors.

# 110.9(c)

## Track Lighting Integral Current Limiter

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Track lighting integral current limiters no longer require certification, but these devices must still comply with specified requirements in this section.

**2019 CODE:**

(c) **Track Lighting Integral Current Limiter.** An integral current limiter for line-voltage track lighting shall be recognized for compliance with Part 6 only if it meets all of the following requirements:

~~1. Shall be certified to the Energy Commission as meeting all of the applicable requirements in Section 110.9(c); and~~

~~2. Shall comply with the Lighting Control Installation requirements in accordance with Section 130.4; and~~

~~3. Shall be manufactured so that the current limiter housing is used exclusively on the same manufacturer's track for which it is designed; and~~

~~4. Shall be designed so that the current limiter housing is permanently attached to the track so that the system will be irreparably damaged if the 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; and~~

~~5. Shall employ tamper resistant fasteners for the cover to the wiring compartment; and~~

~~6~~1. Shall have the identical volt-ampere (VA) rating of the current limiter, as installed and rated for compliance with Part 6 clearly marked as follows; and:

A. So that it is visible for the enforcement agency's 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 nonremovable base-plate inside the wiring compartment.

~~7~~2. Shall have a conspicuous factory installed label permanently affixed to the inside of the wiring compartment warning against removing, tampering with, rewiring, or bypassing the device; and

~~8~~3. 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 resubmittal of compliance documentation to the enforcement agency responsible for compliance with the California Title 24, Part 6 Building Energy Efficiency Standards."

**CHANGE SIGNIFICANCE:** The significant changes to this subsection remove certification requirements for track lighting integral current limiters. The reference to Section 130.4 that addresses certification has been removed. The related design and manufacturing specifications referenced in Section 110.9 have also been removed.

This certification requirement was removed due to advancements in solid state lighting technology used in modular lighting systems. Solid state lighting systems have drivers and similar power transformers that limit modular system total power draw. Related updates to Section 130.0 reflect the value of installed efficient lamps used in modular lighting systems. Track lighting system power is no longer based solely on the maximum potential power draw. This change reduces the costs associated with product certification and simplifies compliance.

# 110.9(d)

## Track Lighting Supplementary Overcurrent Protection Panel

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Track lighting supplementary overcurrent protection panels no longer require certification, however devices must still comply with specified requirements in this section.

**2019 CODE:**

**(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 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; and~~

~~2~~1. Shall be listed as defined in Section 100.1; and

~~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; and~~

~~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; and~~

~~5~~2. 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 resubmittal of compliance documentation to the enforcement agency responsible for compliance with the California Title 24, Part 6 Building Energy Efficiency Standards."

**CHANGE SIGNIFICANCE:** The changes to this subsection remove the certification requirements for track lighting supplementary overcurrent protection panels. The reference to Section 130.4 that addressed certification has also been removed. This was done because of advancements in solid state lighting technology used in modular lighting systems. Solid state lighting systems have drivers and similar power transformers that limit modular system total power draw. Related updates to Section 130.0 reflect the value of installed, efficient lamps used in modular lighting systems. Track lighting system power is no longer based solely on maximum potential power draw. The change reduces the costs associated with product certification, and simplifies compliance.

Two requirements remain in Section 110.9(d), addressing product listing and Energy Code compliance. The first states that the product should be listed as defined in Section 100.1, which defers to Article 100 of the *California Electrical Code* for defining these devices.

The second requirement is for an easily seen permanently installed label with a prescribed notification. The notice must state the panel is for energy code compliance only. It also requires that any replacements of the panel's overcurrent protection devices must be the same or lower amperage and prohibits replacement devices or additional devices with higher continuous ampere ratings.

# 110.9(e) and (f)

## JA8 High Efficacy Light Sources and Ballasts for Residential Recessed Luminaires

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Section 110.9(e) and (f) have been removed because the requirements are located in other sections of the Energy Code.

**2019 CODE:**

~~(e) **JA8 High Efficacy Light Sources.** To qualify as JA8 high efficacy light source for compliance with the residential lighting Standards in Section 150.0(k), a residential light source shall be certified to the Energy Commission according to Reference Joint Appendix JA-8. Nonresidential light sources are not required to be certified to the Energy Commission.~~

~~(f) **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.~~

**CHANGE SIGNIFICANCE:** Sections 110.9(e) and (f) have been removed from the Energy Code. The requirements are already stated in Section 150.0(k) for low-rise residential buildings, and in the Reference Joint Appendix JA8 (JA8).

Section 110.9(e) simply referred to Section 150.0(k) and JA8, the mandatory measures for residential lighting. JA8 also addresses the requirements of Section 110.9(f) with technologically neutral standards for product efficacy and rated life.

# 110.10(a)
## Covered Occupancies

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Single-family and low-rise multifamily buildings with installed photovoltaic systems, and healthcare facilities are exempted from the solar ready requirements.

**2019 CODE:**

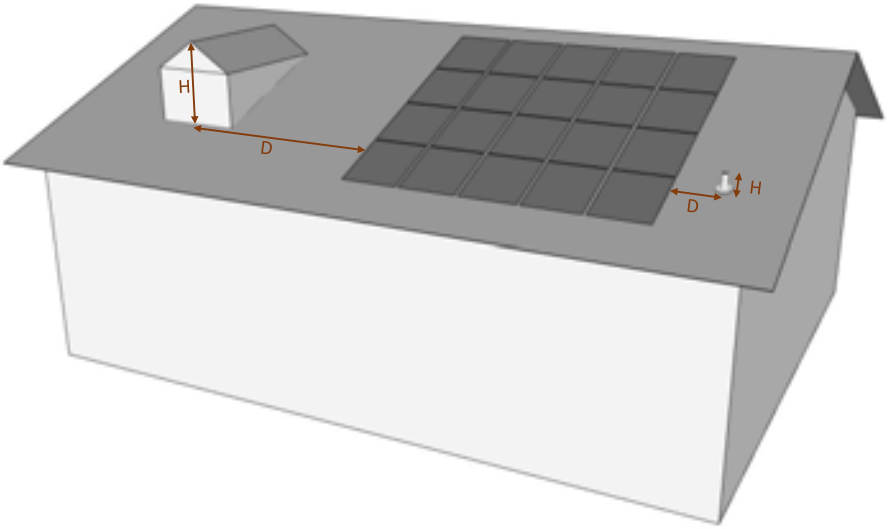
(a) **Covered Occupancies.**

1. **Single Family Residences.** Single family residences located in subdivisions with ten or more single family residences and where the application for a tentative subdivision map for the residences has been deemed complete and approved by the enforcement agency, which do not have a photovoltaic system installed, shall comply with the requirements of Sections 110.10(b) through 110.10(e).
2. **Low-rise ~~Multi-family~~Multifamily Buildings.** Low-rise multifamily buildings that do not have a photovoltaic system installed shall comply with the requirements of Sections 110.10(b) through 110.10(d).
3. **Hotel/Motel Occupancies and High-rise ~~Multi-family~~Multifamily Buildings.** Hotel/motel occupancies and high-rise ~~multi-family~~multifamily buildings with ten habitable stories or fewer shall comply with the requirements of Sections 110.10(b) through 110.10(d).
4. **~~All Other~~ Nonresidential Buildings.** ~~All other~~ Nonresidential buildings with three habitable stories or fewer, other than healthcare facilities, shall comply with the requirements of Sections 110.10(b) through 110.10(d).

**CHANGE SIGNIFICANCE:** The Solar ready requirements require a reserved space for future photovoltaic (PV) systems. The solar-ready requirements do not require installed equipment, other than compliant electrical panels on single-family homes. The 2016 Energy Code previously excluded buildings with PV systems installed by way of an exception in subsequent sections of 110.10. The 2019 Energy Code has now moved that exception into the covered occupancies language. The 2019 Energy Code also now includes solar PV systems in the prescriptive and performance compliance approaches for single-family and low-rise multifamily residential buildings. As a result, most new low-rise residential buildings will be required to have an installed PV system. The changes to Section 110.10(a) address these new requirements by clearly exempting these buildings at the top level of Section 110.10, and because reserved rooftop space is not needed.

The changes to Section 110.10(a)4 remove unneeded language and exclude healthcare facilities from the solar ready scope. Occupancy Groups I-1 and I-2 are now covered by the 2019 Energy Code, although there are exceptions for certain measures. The exception to Section 110.10(a) is necessary because solar ready measures could potentially conflict with

health and safety requirements that govern power management strategies of these buildings. Solar ready requirements for healthcare facilities may be added in future code cycles after more detailed analysis; or a partial exception may be added that is specifically tailored for certain facilities.




Solar Ready Shading Limitations – In order to comply with the shading limits, in this illustration, the distance (D) between the peak of the potential shading object and the solar panels must be twice the height (H) of that peak.
Source: California Energy Commission, 2019 Residential Compliance Manual

# 110.12(a)

## Demand Responsive Controls

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** The demand response and demand management control requirements located in various sections of the 2016 Energy Code have been consolidated into this new section of the 2019 Energy Code. Demand responsive controls must be certified to or compatible with OpenADR 2.0.

**2019 CODE:**

Buildings, other than healthcare facilities, shall comply with the applicable demand responsive control requirements of Sections 110.12(a) through 110.12(d).

(a) **Demand responsive controls.**

1. All demand responsive controls shall be either:
   A. A certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN), as specified under Clause 11, Conformance, in the applicable OpenADR 2.0 Specification; or
   B. Certified by the manufacturer as being capable of responding to a demand response signal from a certified OpenADR 2.0b Virtual End Node by automatically implementing the control functions requested by the Virtual End Node for the equipment it controls.
2. All demand responsive controls shall be capable of communicating using one or more of the following: Wi-Fi, ZigBee, BACnet, Ethernet, or hard-wiring.
3. Demand responsive controls may incorporate and use additional protocols beyond those specified in Sections 110.12(a)1 and 2.
4. When communications are disabled or unavailable, all demand responsive controls shall continue to perform all other control functions provided by the control.
5. Demand responsive control thermostats shall comply with Reference Joint Appendix 5 (JA5), Technical Specifications For Occupant Controlled Smart Thermostats.

(b) **Demand Responsive Zonal HVAC Controls.** Nonresidential 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 increase the operating cooling temperature set points by 4 degrees or more in all noncritical 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 decrease the operating heating temperature set points by 4 degrees or more in all noncritical 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 noncritical 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 increase, decrease, 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 Sections 110.12(b)1 and 110.12(b)2, for noncritical zones during the demand response period.

(c) **Demand Responsive Lighting Controls.** Lighting controls in nonresidential buildings larger than 10,000 square feet shall be capable of automatically reducing lighting power in response to a Demand Response Signal. General lighting shall be reduced in a manner consistent with the uniform level of illumination requirements in TABLE 130.1-A.

1. For compliance testing, the lighting controls shall demonstrate a lighting power reduction in controlled spaces of a minimum of 15 percent below the total installed lighting power. The controls may provide additional demand responsive functions or abilities.

**EXCEPTION 1 to 110.12(c):** Spaces with a lighting power density of 0.5 watts per square foot or less are not required to install demand responsive controls and do not count toward the 10,000 square foot threshold.

**EXCEPTION 2 to 110.12(c):** Spaces where a health or life safety statute, ordinance, or regulation does not permit the lighting to be reduced are not required to install demand responsive controls and do not count toward the 10,000 square foot threshold.

(d) **Demand Responsive Electronic Message Center Control.** Controls for electronic message centers greater than 15 kW shall be capable of reducing the lighting power by a minimum of 30 percent when receiving a demand response signal.

**EXCEPTION to Section 110.12(d):** Electronic message centers that are not permitted by a health or life safety statute, ordinance, or regulation to be reduced.

**CHANGE SIGNIFICANCE:** Section 110.12 is a new section that helps streamline Energy Code requirements. All the demand response (DR) and demand management (DM) requirements are now in one single location.

Although licensed healthcare facilities are included in the scope of the Energy Code for the first time, they are exempt from the demand response and demand management requirements. These measures could potentially conflict with health and safety requirements by affecting the power management strategies of these facilities. After more detailed analysis for future code cycles, the exception could be removed, or modified with partial exceptions for specific types of healthcare facilities.

Section 110.12(a) specifies communication protocols and capabilities for DR controls, including thermostats. DR controls must be compatible with OpenADR 2.0a or 2.0b. The OpenADR 2.0 specification resulted from a prior requirement to incorporate "at least one standards-based

messaging protocol" for nonresidential devices. The specification also resulted from a prior requirement to incorporate either OpenADR2.0 or SEP 1.1 for residential devices. Specifying a communications protocol ensures that building management systems will continue to function even if proprietary software is updated, or technical support ceases. The technical specifications for occupant controlled smart thermostats are located in Reference Joint Appendix JA5 (JA5).

Section 110.12(b) specifies capabilities and programming for demand responsive zonal HVAC controls. Nonresidential HVAC systems must be capable of remotely controlling temperature settings and be programmed to adjust temperature changes. The controls must have three features: (1) disable, (2) manual control, and (3) automatic demand shed control.

Section 110.12(c) specifies capabilities for DR lighting controls. In nonresidential buildings larger than 10,000 square feet, controls must be capable of reducing lighting power. Note that spaces with a lighting power density of 0.5 watts per square foot or less do not count towards the 10,000 square foot threshold and are not subject to the demand responsive control requirements. The same exclusion applies to spaces where a health or life safety statute, ordinance, or regulation does not permit the lighting to be reduced.

Section 110.12(d) specifies lighting power reduction capabilities for DR electronic message center controls. There is an exception for health or life safety, statute, ordinance, or regulation.

A list of controls certified as an OPENADR 2.0a or b Virtual End Node (VEN) can be found at https://products.openadr.org/. A list of products certified to the California Energy Commission as being capable of responding to open ADR 2.0b VEN can be found at https://www.energy.ca.gov/title24/equipment_cert/.

PART 3

# Nonresidential, High-Rise Residential, Hotel/Motel Occupancies and Covered Processes—Mandatory Requirements

## Subchapter 3

Subchapter 3 identifies mandatory requirements that are applicable to all buildings regulated by the Energy Code except low-rise residential buildings. This includes high-rise residential, nonresidential, hotel/motel buildings, and covered processes. This subchapter spans from Section 120.0 through 120.9. These sections establish mandatory requirements for the design, installation, and insulation of building envelopes, mechanical ventilation and space conditioning, and service water heating systems for these buildings. It also identifies mandatory acceptance testing requirements for mechanical systems, commissioning requirements for newly constructed nonresidential buildings, and requirements for covered processes. ■

**120.1**
Requirements for Ventilation and Indoor Air Quality

**120.1(b)**
High-rise Residential Buildings

**120.1(b)1**
Air Filtration

**120.1(b)2**
Attached Dwelling Units

**120.1(c)**
Nonresidential and Hotel/Motel Buildings

**120.1(c)1**
Air Filtration

**120.1(c)2**
Natural Ventilation

**120.1(c)3**
Mechanical Ventilation

**120.1(c)4**
Exhaust Ventilation

**120.1(d)**

Operation and Control Requirements for Minimum Quantities of Outdoor Air

**120.1(d)3**

Demand Control Ventilation

**120.1(d)5**

Occupant Sensor Ventilation Control Devices

**120.1(g)**

Air Classification and Recirculation Limitations

**120.2**

Required Controls for Space Conditioning Systems

**120.2(b)**

Criteria for Zonal Thermostatic Controls

**120.2(b)3**

Demand Shed Control Exception

**120.2(b)4**

Thermostatic Controls

**120.2(c)**

Hotel/Motel Guest Room and High-rise Residential Dwelling Unit Thermostats

**120.2(c)**

Hotel/Motel Guest Room and High-rise Residential Dwelling Units

**120.2(e)**

Shut-off and Reset Controls for Space-conditioning Systems

**120.2(e)3**

Occupancy Sensing Zone Controls

**120.2(f)**

Dampers for Air Supply and Exhaust Equipment

**120.2(h)**

Automatic Demand Shed Controls

**120.2(i)**

Economizer Fault Detection and Diagnostics (FDD)

**120.2(j)**

Direct Digital Controls (DDC)

**120.2(k)**

Optimum Start/Stop Controls

**120.3**

Requirements for Pipe Insulation Exception 3 to 120.3(a) General Requirements

**120.3(a)**

General Requirements

**120.3(b)**

Insulation Protection

**TABLE 120.3-A**

Pipe Insulation Thickness

**120.4**

Requirements for Air Distribution System Ducts and Plenums; Exception to Section 120.4

**120.4(a)**

CMC Compliance

**120.5**

Requirements for Nonresidential Mechanical System Acceptance; Exception to Section 120.5(a)

**120.5(a)**

Acceptance Testing

**120.5(a)18**

Occupant Sensing Zone Controls

**120.6**

Mandatory Requirements for Covered Processes

**120.6(a)**

Mandatory Requirements for Refrigerated Warehouses

**120.6(a)4**

Condensers

**120.6(b)**

Mandatory Requirements for Commercial Refrigeration1

**120.6(e)**

Mandatory Requirements for Compressed Air Systems

**120.6(f)**

Mandatory Requirements for Elevators

**120.7**

Mandatory Insulation Requirements

**120.7(b)**

Wall Insulation

**120.8**

Nonresidential Building Commissioning

# 120.1

## Requirements for Ventilation and Indoor Air Quality

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** New indoor air quality requirements in the 2019 Energy Code apply to high-rise residential, hotel motel, and nonresidential buildings.

**2019 CODE:**

**SECTION 120.1 – REQUIREMENTS FOR VENTILATION AND INDOOR AIR QUALITY**

~~Nonresidential, high-rise residential, and hotel/motel buildings shall comply with the requirements of Section 120.1(a) through 120.1(e).~~

(a) **General Requirements.**

1. All occupiable spaces in high-rise residential buildings, hotel/motel buildings, and nonresidential buildings other than healthcare facilities shall comply with the applicable requirements of Section 120.1(a) through 120.1(g). Healthcare facilities shall be ventilated in accordance with Chapter 4 of the *California Mechanical Code.*

~~All enclosed spaces in a building shall be ventilated in accordance with the requirements of this section and the *California Building Code*.~~

~~**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 required outdoor air-ventilation rate and the air-distribution system design ~~assumptions made in the design of the ventilating system~~ shall be clearly identified on the plans in accordance with ~~required by~~ Section 10-103 of Title 24, Part 1.

**CHANGE SIGNIFICANCE:** The title of Section 120.1 has been updated to reflect new requirements for indoor air quality (IAQ). The change describes the contents of this extensive revision. It also aligns with the titles of ASHRAE 62.1 and ASHRAE 62.2, where most of the ventilation and IAQ requirements come from.

The additional language in Section 120.1(a)1 clarifies the section's scope. Healthcare facilities are now covered by the Energy Code but have different ventilation requirements than the other covered occupancies. This change is necessary to inform users of the Energy Code that the ventilation rate requirements for healthcare facilities are found in the *California Mechanical Code*, not in the Energy Code.

STATE OF CALIFORNIA

**Mechanical Systems**

NRCC-MCH-E (Created 7/20) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE NRCC-MCH-E

*This document is used to demonstrate compliance for mechanical systems that are within the scope of the permit application and are demonstrating compliance using the prescriptive path outlined in §140.4, or §141.0(b)2 for alterations.*

| Project Name: | Report Page: Page 1 of 8 |
|---|---|
| Project Address: | Date Prepared: |

**A. GENERAL INFORMATION**

| | | | | | |
|---|---|---|---|---|---|
| 01 | Project Location (city) | | 04 | Total Conditioned Floor Area | |
| 02 | Climate Zone | | 05 | Total Unconditioned Floor Area | |
| 03 | Occupancy Types Within Project: | | 06 | # of Stories (Habitable Above Grade) | |

| | | |
|---|---|---|
| ☐ Office (B) | ☐ Retail (M) | ☐ Non-refrigerated Warehouse (S) |
| ☐ Hotel/ Motel Guest Rooms (R-1) | ☐ School (E) | ☐ Healthcare Facility (I) |
| ☐ High-Rise Residential (R-2/R-3) | ☐ Relocatable Class Bldg (E) | ☐ Other (Write In): |

[1] *FOOTNOTES: Climate zone can be determined on the California Energy Commission's website at http://www.energy.ca.gov/maps/renewable/building_climate_zones.html*

**B. PROJECT SCOPE**

*Table Instructions: Include any mechanical systems that are within the scope of the permit application and are demonstrating compliance using the prescriptive path outlined in §140.4, or §141.0(b)2 for alterations.*

| My project consists of (check all that apply) | | |
|---|---|---|
| 01 | 02 | 03 |
| Air System(s) | Wet System Components | Dry System Components |
| ☐ Heating Air System | ☐ Water Economizer | ☐ Air Economizer |
| ☐ Cooling Air System | ☐ Pumps | ☐ Electric Resistance Heat |
| Mechanical Controls | ☐ Hydronic System Piping | ☐ Fan Systems |
| ☐ Mechanical Controls (existing to remain, altered or new) | ☐ Cooling Towers | ☐ Ductwork (existing to remain, altered or new) |
| | ☐ Chillers | ☐ Ventilation |
| | ☐ Boilers | ☐ Zonal Systems/ Terminal Boxes |

**C. COMPLIANCE RESULTS**

*Table Instructions: If any cell on this table says "DOES NOT COMPLY" or "COMPLIES with Exceptional Conditions" refer to Table D. for guidance.*

| 01 | | 02 | | 03 | | 04 | | 05 | | 06 | | 07 | | 08 | 09 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| System Summary §110.1, §110.2, §140.4 | AND | Pumps §140.4(k) | AND | Fans/ Economizers §140.4(c), §140.4(e) | AND | System Controls §110.2, §120.2, §140.4(f) | AND | Ventilation §120.1 | AND | Terminal Box Controls §140.4(d) | AND | Distribution §120.3, §140.4(l) | AND | Cooling Towers §110.2(e)2 | **Compliance Results** |
| (See Table F) | | (See Table G) | | (See Table H) | | (See Table I) | | (See Table J) | | (See Table K) | | (See Table L) | | (See Table M) | |
| No | AND | | AND | | AND | | AND | No | AND | | AND | | AND | | **DOES NOT COMPLY** |
| | | | | | | | | | | | | | | **Mandatory Measures Compliance (See Table Q for Details)** | **DOES NOT COMPLY** |

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance: http://www.energy.ca.gov/title24/2019standards/ July 2020

2019 Nonresidential Certificate of Compliance for Mechanical Systems
Source: California Energy Commission

# 120.1(b)1

## High-rise Residential Buildings, Air Filtration

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** This is a new section that focuses on indoor air quality (IAQ) for high-rise residential buildings and includes filtration system efficiency and ventilation system design requirements.

**2019 CODE:**

(b) **High-rise Residential Buildings.**

Attached dwellings units shall comply with the requirements of subsections 1 and 2 below. Occupiable spaces other than attached dwelling units shall comply with the requirements of Section 120.1(c).

1. **Air Filtration.**

A. System types specified in subsections i, ii, and iii shall be provided with air filters in accordance with Sections 120.1(b)1B through 1D. System types specified in subsection i shall also comply with Section 120.1(b)1E.

i. Mechanical space conditioning systems that supply air to an occupiable space through ductwork exceeding 10 ft (3 m) in length.

ii. Mechanical supply-only ventilation systems that provide outside air to an occupiable space.

iii. The supply side of mechanical balanced ventilation systems, including heat recovery ventilation systems and energy recovery ventilation systems that provide outside air to an occupiable space.

B. **System Design and Installation.**

i. The system shall be designed to ensure that all recirculated air or outdoor air supplied to the occupiable space is filtered before passing through any system thermal conditioning components.

**EXCEPTION to Section 120.1(b)1Bi:** For heat recovery ventilators and energy recovery ventilators the location of the filters required by Section 120.1(b) may be downstream of a system thermal conditioning component, provided the system is equipped with ancillary filtration upstream of the system's thermal conditioning component.

ii. All systems shall be designed to accommodate the clean-filter pressure drop imposed by the system air filter(s). The design airflow rate, and maximum allowable clean-filter pressure drop at the design airflow rate applicable to each air filter shall be determined and reported on labels according to subsection iv below.

Systems specified in Section 120.1(b)1Ai shall be equipped with air filters that meet either subsection a or b below:

a. Nominal two-inch minimum depth filter(s) shall be sized by the system designer; or

b. Nominal one-inch minimum depth filters(s) shall be allowed if the filter(s) are sized according to Equation 120.1-A, based on a maximum face velocity of 150 ft per minute and according to the maximum allowable clean filter pressure drop specified in Section 120.1(b)1Dii

$A_{face} = Q_{filter} / V_{face}$ (Equation 120.1-A)

Where,

$A_{face}$ = air filter face area, the product of air filter nominal length x nominal width, $ft^2$

$Q_{filter}$ = design airflow rate for the air filter, $ft^3$/min

$V_{face}$ = air filter face velocity ≤ 150, ft/min

iii. All system air filters shall be located and installed in such a manner as to be accessible for regular service by the system owner.

iv. All system air filter installation locations shall be labeled to disclose the applicable design airflow rate and the maximum allowable clean-filter pressure drop. The labels shall be permanently affixed to the air filter installation location, readily legible, and visible to a person replacing the air filter.

C. **Air Filter Efficiency.** The system shall be provided with air filter(s) having a designated efficiency equal to or greater than MERV 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30–1.0 µm range and equal to or greater than 85 percent in the 1.0–3.0 µm range, when tested in accordance with AHRI Standard 680.

D. **Air Filter Pressure Drop.** All systems shall be provided with air filter(s) that conform to the applicable maximum allowable clean-filter pressure drop specified by i, ii or iii below, when tested using ASHRAE Standard 52.2, or as rated using AHRI Standard 680, for the applicable design airflow rate(s) for the system air filter(s).

i. The maximum allowable clean-filter pressure drop determined by the system design for the nominal two inch minimum depth air filter required by Section 120.1(b)1Biia; or

ii. A maximum of 25 PA (0.1 in. of water) clean-filter pressure drop shall be allowed for a nominal one-inch depth air filter sized according to Section 120.1(b)1Biib; or

iii. For system specified in 120.1(b)1Aii, and 120.1(b)1Aiii, the maximum allowable clean filter pressure drop determined by the system design.

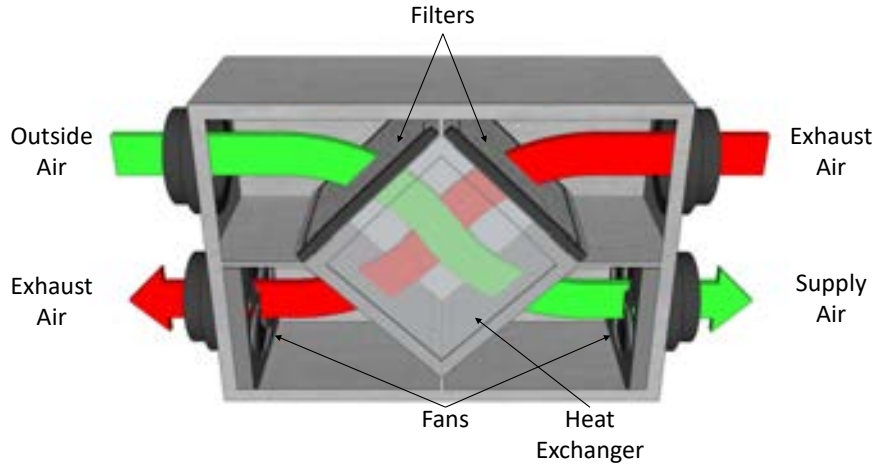
E. **Air Filter Product Labeling.** Systems described in 120.1(b)1Ai shall be equipped with air filters that have been labeled by the manufacturer to disclose the efficiency and pressure drop ratings that demonstrate conformance with Sections 120.1(b)1.

**EXCEPTION to Section 120.1(b)1:** Evaporative coolers are not subject to the air filtration requirements of Section 120.1(b)1.

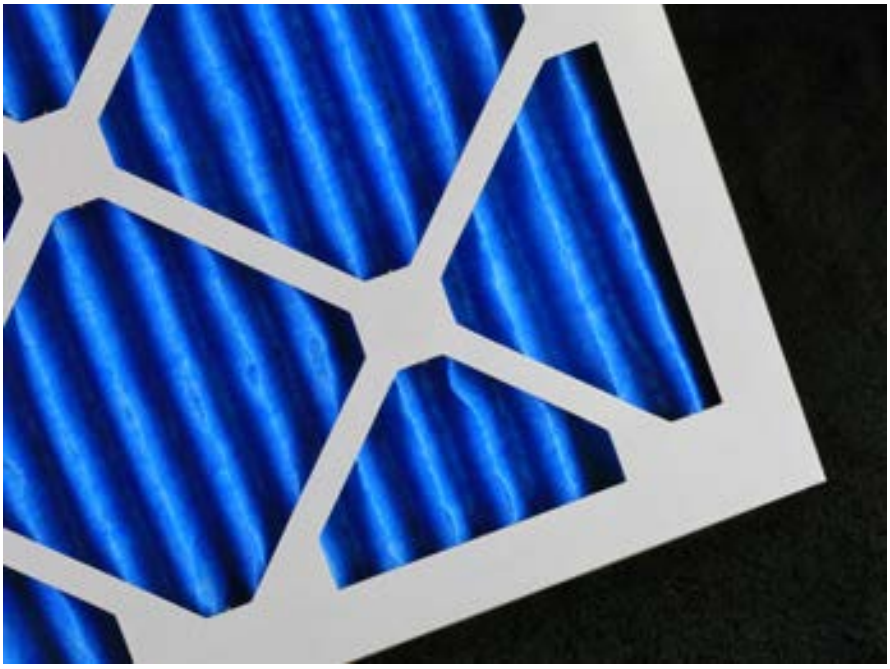
**CHANGE SIGNIFICANCE:** Section 120.1(b)1 improves indoor air quality of high-rise residential dwelling units by increasing the air filtration particle size efficiency requirement in space conditioning systems from MERV 6 to MERV 13. Air filters are now required to be at least 2 inches in depth for improved filter airflow, or 1 inch in depth if 0.1 inch w.c. (25 Pascals) pressure drop and 150 feet per minute filter face velocity are used for the design.

Supply ventilation systems and the supply side of balanced ventilation systems (including heat recovery ventilation and energy recovery ventilation systems) are now required to have MERV 13 air filtration. Ventilation system filters are not required to be two inches and the ventilation system pressure drop may be determined by the designer while maintaining the required ventilation rate delivered to the dwelling unit.

New information about the effects of indoor particulate pollutants was a consideration of new and amended standards for 2019, noting that filters meeting current MERV 6 and MERV 8 requirements are only moderately effective at filtering out airborne particulates (PM10) and are unable to capture or filter out fine particulates (PM2.5). Energy Commission staff identified a MERV rating of 13 as being effective at filtering out fine particulate matter (PM2.5).




Energy Recovery Ventilator – The supply air (green arrow) must pass through a MERV 13 filter.
Source: California Energy Commission



Getty Images

HVAC Filter – MERV 13 Filters are now required for ducted HVAC systems, and on the the supply side of ventilation systems.

# 120.1(b)2

## High-rise Residential Buildings, Attached Dwelling Units

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** ASHRAE Standard 62.2-2016 "Ventilation and Acceptable Indoor Air Quality in Residential Buildings" is incorporated by reference with California-specific amendments. HERS verification of minimum airflow and HVI certification status is required for kitchen range hoods.

**2019 CODE:**

(b) **High-rise Residential Buildings.**

Attached dwellings units shall comply with the requirements of subsections 1 and 2 below. Occupiable spaces other than attached dwelling units shall comply with the requirements of Section 120.1(c).

[…]

1. **Attached dwelling units.** All dwelling units shall meet the requirements of ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings, subject to the amendments specified in subsection A below. All dwelling units shall comply with the Acceptance requirements specified in subsection B below.

**A. Amendments to ASHRAE 62.2 requirements.**

i. Window operation is not a permissible method of providing the dwelling unit ventilation airflow specified in subsections iv or v below.

ii. Continuous operation of central forced air system air handlers used in central fan integrated ventilation systems is not a permissible method of providing the dwelling unit ventilation airflow required in Section 4 of ASHRAE Standard 62.2.

**EXCEPTION to Section 120.1(b)2Aii:** The Energy Commission may approve continuous operation of central fan integrated ventilation systems pursuant to Section 10-109(h).

iii. Air filtration shall conform to the specifications in Section 120.1(b)1. Compliance with ASHRAE 62.2 Sections 6.7 (Minimum Filtration) and 6.7.1 (Filter Pressure Drop) shall not be required.

iv. Multifamily attached dwelling units shall comply with subsections a and b.

a. Mechanical ventilation airflow shall be provided at rates determined in accordance with Equation 120.1-B.

Total Required Ventilation Rate [ASHRAE 62.2.4.1.1]

$$Q_{tot} = 0.03A_{floor} + 7.5(N_{br} + 1)$$ **(Equation 120.1-B)**

Where,

$Q_{tot}$ = total required ventilation rate, cfm

$A_{floor}$ = dwelling-unit floor area, $ft^2$

$N_{br}$ = number of bedrooms (not to be less than 1)

b. The mechanical ventilation system shall comply with one of the following subsections 1 or 2 below. When subsection 2 is utilized for compliance, all dwelling units in the multifamily building shall use the same ventilation system type.

1. A balanced mechanical ventilation system shall provide the required dwelling-unit ventilation airflow.

2. Continuously operating supply ventilation systems or continuous operating exhaust ventilation systems shall be allowed to be used to provide the required dwelling unit ventilation airflow if the dwelling-unit envelope leakage is less than or equal to 0.3 cubic feet per minute at 50 Pa (0.2 in. of water) per $ft^2$ of dwelling unit envelope surface area as confirmed by field verification and diagnostic testing in accordance with Reference Nonresidential Appendix NA7.18.2.

v. Multifamily building central ventilation systems that serve multiple dwelling-units shall be balanced to provide ventilation airflow to each dwelling-unit served at a rate equal to or greater than the rate specified by Equation 120.1-B, but not more than twenty percent greater than the specified rate. These systems shall utilize balancing means to ensure the dwelling unit airflows can be adjusted to meet this balancing requirement. These system balancing means may include but not be limited to constant air regulation devices, orifice plates, and variable speed central fans.

vi. Kitchen range hoods shall be rated for sound in accordance with Section 7.2 of ASHRAE 62.2.

**EXCEPTION to Section 120.1(b)2Avii:** Kitchen range hoods may be rated for sound at a static pressure determined at working speed as specified in HVI 916 Section 7.2.

vii. Compliance with ASHRAE 62.2 Section 6.5.2 (Space Conditioning System Ducts) shall not be required.

viii. Compliance with ASHRAE 62.2 Section 4.4 (Control and Operation) shall require manual switches associated with dwelling unit ventilation systems to have a label clearly displaying the following text, or equivalent text: "This switch controls the indoor air quality ventilation for the home. Leave it on unless the outdoor air quality is very poor."

B. **High-Rise Residential Dwelling Unit Acceptance.**

i. Airflow Performance. The dwelling-unit ventilation airflow required by Section 120.1(b)2Aiv or 120.1(b)2Av shall be confirmed through field verification and diagnostic testing in accordance with Reference Nonresidential Appendix NA7.18.1.

ii. Kitchen Range Hoods. The installed kitchen range hood shall be field verified in accordance with Reference Nonresidential Appendix NA7.18.1 to confirm the model is rated by HVI to comply with the following requirements:

a. The minimum ventilation airflow rate as specified in Section 5 of ASHRAE 62.2.

b. The maximum sound rating as specified in Section 120.1(b)2Avi.

~~**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:~~

~~A. The conditioned floor area of the space times the applicable ventilation rate from TABLE 120.1-A; or~~

~~B. 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:~~

~~A. None of the spaces from which air is transferred have any unusual sources of indoor air contaminants; and~~

~~B. 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.~~

**CHANGE SIGNIFICANCE:** Section 120.1(b)2A incorporates ASHRAE Standard 62.2-2016 "Ventilation and Acceptable Indoor Air Quality in Residential Buildings" by reference, with California-specific amendments described in subsections Ai through vi. Subsection 2B requires HERS verification of minimum airflow and HVI certification status for kitchen range hoods.

Subsection Ai states that window operation is not a permissible method of providing ventilation to the dwelling unit. This requirement mirrors the same restriction for low-rise residential dwelling units. The change ensures that mechanical ventilation will be used to comply with the minimum air ventilation requirement.

Subsection Aii addresses the central forced air system air handlers in central fan integrated ventilation systems. Continuous operation of these systems is not an allowable method of providing ventilation to the dwelling unit. Air handler fans consume a fair amount of energy and are an energy intensive method of providing ventilation. Also, central fan integrated ventilation systems may not be an effective way to provide fresh air in high-rise structures due to building pressure issues (the "stack effect"). However, the exception allows energy efficient designs that achieve proper outside air flow. The design must be approved as an Energy Commission compliance option. See Sections 10-104 and 10-109 in Title 24, Part 1 for information about "exceptional design" requirements and approvals.

Subsection Aiii simplifies the method for calculating the required mechanical ventilation airflow rate for multifamily attached dwelling units specified by ASHRAE 62.2. The calculation uses a fixed default value based on a dwelling enclosure leakage rate of 2 air changes per hour at 50 Pa (2ACH50). This will simplify the mandatory field measurement of dwelling enclosure leakage, and is necessary for consistency with the updates to Section 120.1(b)1.

Subsection Aiv specifies two options for mechanically ventilating high-rise dwellings. Broadly speaking, there are three ways to mechanically ventilate a space: you can supply air to the space, which adds new outside air and pressurizes the space; you can exhaust the air in the space, which depressurizes the space and causes air to be pulled into the dwelling from its surroundings; or you can balance supply and exhaust ventilation so that air is exchanged without creating a pressure differential. For dwelling units sharing walls with other indoor spaces, nonbalanced ventilation approaches are potentially less effective and less energy efficient than balanced ventilation approaches. This is because pressurizing a space means pushing depleted or polluted air into those adjacent spaces; depressurizing a space means pulling depleted or polluted air in from adjacent spaces. A balanced ventilation strategy ensures that air is exchanged with the outside, and not with adjacent dwellings or indoor spaces.

Option one of subsection Aiv requires balanced ventilation systems that supply the same amount of outside air as they exhaust. This minimizes any pressure differences between dwellings that could cause transfer of contaminated air between units.

Option two of subsection Aiv allows for supply only or exhaust only if the dwelling unit is sealed to minimize leakage between adjacent dwelling units, such that the enclosure leakage is less than 0.3 cubic feet per minute at 50 Pa (0.2 inch water) per square feet of enclosure area. The leakage rate is determined by a field test performed by a HERS Rater. This ensures that energy used for ventilation efficiently provides its intended benefit to indoor air quality and is not wasted on pulling or pushing depleted or polluted air back and forth between adjacent dwellings.

Subsection Av applies to multifamily buildings with central ventilation systems that serve multiple dwelling units. The system must be balanced such that the airflow rate for every dwelling unit is greater than or equal to the rate specified by ASHRAE 62.2 section 4.1.1. However, the airflow rate must be no more than twenty percent greater than the specified rate. The system designer may choose to include constant air regulation devices, orifice plates, variable speed central fans, or other components that achieve compliance. The whole-building pressure relationship (between dwellings and other spaces) is an extremely important characteristic that impacts the ventilation system's ability to provide outside air to the space. This code change limits the impact of high differential pressures throughout the building, and avoids inadvertent impacts on indoor air quality.

Subsection Avi incorporates high-rise residential kitchen range hood sound rating requirements to be consistent with low-rise residential requirements in Section 150.0(o)1G, ensuring the requirements will be applied for all residential buildings.

Subsection Avii specifies that compliance with ASHRAE 62.2 Section 6.5.2 (Space Conditioning System Ducts) is not required. The change was needed to eliminate a conflict between the ASHRAE 62.2 duct leakage requirements and existing duct leakage requirements in the Energy Code.

Subsection Aviii specifies the text for the labels on mechanical ventilation fan controls required by ASHRAE 62.2 Section 4.4. It addresses concerns that IAQ ventilation fans are often turned off by dwelling occupants who do not understand that the fans must be operated in order to protect the quality of the indoor air.

Section 120.1(b)2B requires HERS verification of dwelling unit ventilation rate and HERS verification of kitchen range hood airflow, sound rating, and HVI certification. Indoor pollutants from inadequate range hood exhaust performance are a significant danger to human health. Minimum airflow was not a HERS-verified measure in the 2016 Energy Code.

*Getty Images*

Range Hood – Residential kitchen range hoods require HERS verification under the 2019 Energy Code.

# 120.1(c)1

## Nonresidential and Hotel/Motel Buildings, Air Filter

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** New requirements for air filtration systems and performance, with specified mechanical systems, and air filter efficiency and sizes.

**2019 CODE:**

(c) **Nonresidential and Hotel/Motel Buildings.** All occupiable spaces shall meet the requirements of subsection 1 and either 2 or 3:

1. **Air Filtration.**

   A. Mechanical system types described in Section 120.1(b)1A shall be provided with air filters to clean the outside and return air prior to its introduction into occupied spaces.

   B. Air Filter Efficiency. The filters shall have a designated efficiency equal to or greater than MERV 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30-1.0 µm range, and equal to or greater than 85 percent in the 1.0-3.0 µm range when tested in accordance with AHRI Standard 680; and

   C. Systems shall be equipped with air filters that meet either subsection i or ii below.

      i. Nominal two inch minimum depth filter(s); or

      ii. Nominal one inch minimum depth filter(s) shall be allowed if the filter(s) are sized according to Equation 120.1-A, based on a maximum face velocity of 150 ft per minute.

**CHANGE SIGNIFICANCE:** The extensive changes to Section 120.1 address outdoor air ventilation and indoor air quality (IAQ) with new requirements for air filtration and system designs. Subsection (c) applies to the occupiable spaces in high-rise nonresidential buildings, and hotels/motels. Subsection (c)1 addresses air filtration. It specifies the types of mechanical systems that must have air filters, air filter efficiency, and sizes. The 2019 Energy Code ensures that HVAC systems are designed to accommodate higher MERV filters so that occupants can improve filtration without inadvertently harming the energy efficiency, lifespan, or overall performance of their HVAC system.

Three types of mechanical systems are subject to the air filtration requirements, and are specified by reference to Section 120.1(b)1A. These systems must have air filters to clean the outside and return air before the air enters the occupied spaces. The three system types are:

- Systems that supply air to an occupiable space through ductwork exceeding 10 feet (3 m) in length.
- Mechanical supply-only ventilation systems that provide outside air to an occupiable space.
- The supply side of mechanical balanced ventilation systems, including heat recovery ventilation systems and energy recovery ventilation systems that provide outside air to an occupiable space.

To improve indoor air quality, the air filtration particle size efficiency requirement has increased from MERV 6 to MERV 13. A MERV 13 filter effectively filters out fine particulate matter (PM 2.5). There are two options specified for particle size filtration:

- ≥ MERV 13 when tested in accordance with ASHRAE Standard 52.2.
- Particle size efficiency rating ≥ 50% in the 0.30–1.0 µm range, and ≥ 85% in the 1.0–3.0 µm range when tested in accordance with AHRI Standard 680.

The Energy Code requires these filters to meet one of the following size options:

- Nominal two-inch minimum depth filter(s); or
- Nominal one-inch minimum depth filter(s) if the filter(s) are sized according to Equation 120.1-A, based on a maximum face velocity of 150 feet per minute.

# 120.1(c)2

## Nonresidential and Hotel/Motel Buildings, Natural Ventilation

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Natural ventilation requirements with specifications for design, operation, and mechanical systems, including floor area, openings, and controls.

**2019 CODE:**

(c) **Nonresidential and Hotel/Motel Buildings.** All occupiable spaces shall meet the requirements of subsection 1 and either 2 or 3:

[…]

2. **Natural Ventilation.** Naturally ventilated spaces shall be designed in accordance with 120.1(c)2A through 120.1(c)2C and include a mechanical ventilation system designed in accordance with 120.2(c)3:

A. Floor area to be ventilated. Spaces or portions of spaces to be naturally ventilated shall be located within a distance based on the ceiling height, as specified in i, ii and iii. The ceiling height (H) to be used in i, ii or iii shall be the minimum ceiling height in the space, or for ceilings that are increasing in height as distance from the operable openings is increased, the ceiling height shall be determined as the average height of the ceiling within 20 ft from the operable opening. [ASHRAE 62.1:6.4.1]

i. Single Side Opening. For spaces with operable opening on one side of the space, the maximum distance from the operable opening shall be not more than 2H. [ASHRAE 62.1:6.4.1.1]

ii. Double Side Opening. For spaces with operable openings on two opposite sides of the space, the maximum distance from the operable opening shall be not more than 5H. [ASHRAE 62.1:6.4.1.2]

iii. Corner Opening. For spaces with operable openings on two adjacent sides of a space, the maximum distance from the operable openings shall be not more than 5H along a line drawn between the two openings that are the farthest apart. Floor area outside that line shall comply with i or ii. [ASHRAE 62.1:6.4.1.3]

iv. Ceiling Height. The ceiling height (h) to be used in Section 120.1(c)2Ai through 120.1(c)2Aiii shall be the minimum ceiling height in the space.

**EXCEPTION to Section 120.1(c)2Aiv:** For ceilings that are increasing in height as distance from the opening is increased, the ceiling height shall be determined as the average height of the ceiling within 20 feet from the operable openings. [ASHRAE 62.1:6.4.1.4]

B. Location and Size of Openings. Spaces or portions of spaces to be naturally ventilated shall be permanently open to operable wall openings directly to the outdoors. The openable area shall be not less than 4 percent of the net occupiable floor area. Where openings are covered with louvers or otherwise

obstructed, the openable area shall be based on the net free unobstructed area through the opening. Where interior rooms, or portions of rooms, without direct openings to the outdoors are ventilated through adjoining rooms, the opening between rooms shall be permanently unobstructed and have a free area of not less than 8 percent of the area of the interior room or less than 25 square feet. [ASHRAE 62.1:6.4.2]

C. Control and Accessibility. The means to open the required operable opening shall be readily accessible to building occupants whenever the space is occupied. Controls shall be designed to coordinate operation of the natural and mechanical ventilation systems. [ASHRAE 62.1:6.4.3]

**EXCEPTION 1 to Section 120.1(c)2:** The mechanical ventilation system shall not be required where natural ventilation openings complying with 120.1(c)2 are either permanently open or have controls that prevent the openings from being closed during periods of expected occupancy.

**EXCEPTION 2 to Section 120.1(c)2:** The mechanical ventilation system shall not be required where the zone is not served by a space conditioning system.

**CHANGE SIGNIFICANCE:** The extensive changes to Section 120.1 address outdoor air ventilation and indoor air quality (IAQ) with new requirements for air filtration and ventilation system designs. Subsection (c) applies to occupiable spaces in hotel/motel and nonresidential buildings. The occupiable spaces must meet air filter efficiency requirements in subsection (c)1 and mechanical system specifications in (c)3. This discussion covers the natural ventilation system requirements in (c)2.

Even when natural ventilation is used, the buildings must include a mechanical ventilation system, although there are two exceptions. Exception 1 explains that a mechanical ventilation system is not required when natural ventilation openings are either permanently open, or have controls that prevent closure during periods of expected occupancy. Exception 2 allows spaces to not be served by a mechanical ventilation system if the zone is not served by a space conditioning system.

The 2016 Energy Code allowed natural ventilation; however, a new, more detailed procedure helps determine the correct location of ventilation openings in occupiable spaces. This subsection aligns the 2019 Energy Code with the natural ventilation procedure of ASHRAE 62.1-2016.

The space's floor area and ceiling height (H) are the primary factors when calculating the allowable location of ventilation openings. (H) is the minimum ceiling height in the space. In a scenario where the ceiling height varies, and the distance from the operable openings also varies, the exception to Section 120.1(c)2Aiv specifies that (H) will be the average height of the ceiling, as measured within 20 feet of the ventilation opening [ASHRAE 62.1:6.4.1].

For spaces with an operable ventilation opening on only one side, the maximum distance from the operable opening must be ≤ 2H [ASHRAE 62.1:6.4.1.1].

For spaces with operable ventilation openings on two opposite sides, the maximum distance from the operable opening must be ≤ 5H. [ASHRAE 62.1:6.4.1.2]

For spaces with operable openings on the two adjacent sides of a corner, the maximum distance from the operable openings must be ≤ 5H along a line drawn between the two openings that are the farthest apart.

Naturally ventilated spaces must have wall openings that directly access the outdoors, and the openings must be operable. The openings must be ≤ 4 percent of the total net floor area. If openings are covered with louvers or other obstructions, the openings' area size is considered to be the total of unobstructed area.

In a scenario where an interior room without direct outdoor openings is ventilated through adjoining rooms, the opening between rooms must be permanently unobstructed with a free area of at least 8 percent of the interior room area, or no less than 25 square feet. [ASHRAE 62.1:6.4.2]

Operable openings must be readily accessible to the building occupants whenever the space is occupied. Any controls must be designed for coordination between the natural and mechanical ventilation systems. [ASHRAE 62.1:6.4.3]

# 120.1(c)3

## Nonresidential and Hotel/Motel Buildings Mechanical Ventilation

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Mechanical ventilation systems must provide specified outdoor airflow rate. Table 120.1-A significantly expanded to more easily determine minimum ventilation rates.

**2019 CODE:**

(c) **Nonresidential and Hotel/Motel Buildings.** All occupiable spaces shall meet the requirements of subsection 1 and either 2 or 3:

[…]

**3. Mechanical Ventilation.** Occupiable spaces shall be ventilated with a mechanical ventilation system capable of providing an outdoor airflow rate ($V_z$) to the zone no less than the larger of A or B as described below:

A. The outdoor airflow rate to the zone ($V_z$) shall be determined in accordance with Equation 120.1-F; or

$$V_z = R_a \times A_z \quad \textbf{(Equation 120.1-F)}$$

Where:

$R_a$ = Outdoor airflow rate required per unit area as determined from Table 120.1-A.

$A_z$ = Zone floor area is the net occupiable floor area of the ventilation zone in square feet.

B. For spaces designed for an expected number of occupants or spaces with fixed seating, the outdoor airflow rate to the zone ($V_z$) shall be determined in accordance with Equation 120.1-G;

$$V_z = R_p \times P_z \quad \textbf{(Equation 120.1-G)}$$

Where:

$R_p$ = 15 cubic feet per minute of outdoor airflow per person

$P_z$ = The expected number of occupants. The expected number of occupants shall be the expected number specified by the building designer. For spaces with fixed seating, the expected number of occupants shall be determined in accordance with the *California Building Code*.

**EXCEPTION to Section 120.1(c)3: Transfer air.** The rate of outdoor air required by Section 120.1(c)3 may be provided with air transferred from other ventilated space if:

A. Use of transfer air is in accordance with Section 120.1(g); and

B. The outdoor air that is supplied to all spaces combined, is sufficient to meet the requirements of Section 120.1(c)3 for each space individually.

**CHANGE SIGNIFICANCE:** The extensive changes to Section 120.1 address outdoor air ventilation and indoor air quality (IAQ) with new requirements for air filtration and system designs. Subsection (c) applies to the occupiable spaces in hotels/motels and nonresidential buildings. Air filter efficiency requirements are in subsection (c)1, and the outdoor airflow rates for mechanical systems are in (c)3. Most spaces using natural

ventilation complying with (c)2 will also need to comply with these mechanical system airflow rates.

Mechanical ventilation systems must be capable of providing a specified outdoor airflow rate ($V_z$) to the zone. The changes provide more direction for determining minimum ventilation rates. There are two calculations. The first calculation is specified in Equation 120.1-F. The second calculation is for spaces with fixed seating or an expected number of occupants. That calculation, Equation 120.1-G, includes the number of expected occupants.

New minimum ventilation rate calculations have been added to Table 120.1-A. The table includes significantly more information, reducing the need to cross reference between the Building or and Energy Code to determine the minimum ventilation rates. It includes many additional space types (occupancy categories) and identifies the "air classifications" referenced by §120.1(g).

There is one exception that applies when using air transferred from other ventilated space. The exception provides consistency with Section 120.1(g) and allows appropriate use of transfer air.

# 120.1(c)4

## Nonresidential and Hotel/Motel Buildings Exhaust Ventilation

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Exhaust ventilation requirements were added to align the Energy Code with ASHRAE 62.1-2016.

**2019 CODE:**

(c) **Nonresidential and Hotel/Motel Buildings.** All occupiable spaces shall meet the requirements of subsection 1 and either 2 or 3:

[…]

4. **Exhaust Ventilation.** The design exhaust airflow shall be determined in accordance with the requirements in Table 120.1-B. Exhaust makeup air shall be permitted to be any combination of outdoor air, recirculated air, or transfer air. [ASHRAE 62.1:6.5.1]

[…]

**TABLE 120.1-B Minimum Exhaust Rates [ASHRAE 62.1: Table 6.5]**

| Occupancy Category | Exhaust Rete, cfm/unit | Exhaust Rate, cfm/ft² | Air Class | Notes |
|---|---|---|---|---|
| Arenas | - | 0.50 | 1 | B |
| Art classrooms | - | 0.70 | 2 | |
| Auto repair rooms | - | 1.5 | 2 | A |
| Barber shops | - | 0.50 | 2 | |
| Beauty and nail salons | - | 0.60 | 2 | |
| Cells with toilet | - | 1.00 | 2 | |
| Copy, printing rooms | - | 0.50 | 2 | |
| Darkrooms | - | 1.00 | 2 | |
| Educational science laboratories | - | 1.00 | 2 | |
| Janitor closets, trash rooms, recycling | - | 1.00 | 3 | |
| Kitchenettes | - | 0.30 | 2 | |
| Kitchens – commercial | - | 0.70 | 2 | |
| Locker rooms for athletic or industrial facilities | - | 0.50 | 2 | |
| All other locker rooms | - | 0.25 | 2 | |
| Shower rooms | 20/50 | - | 2 | G,H |
| Paint spray booths | - | - | 4 | F |
| Parking garages | - | 0.75 | 2 | C |
| Pet shops (animal areas) | - | 0.90 | 2 | |

*Table 120.1-B continues*

*Table 120.1-B continued*

**TABLE 120.1-B Minimum Exhaust Rates [ASHRAE 62.1: Table 6.5]**

| Occupancy Category | Exhaust Rete, cfm/unit | Exhaust Rate, cfm/ft² | Air Class | Notes |
|---|---|---|---|---|
| Pet shops (animal areas) | - | 0.90 | 2 | |
| Refrigerating machinery rooms | - | - | 3 | F |
| Soiled laundry storage rooms | - | 1.00 | 3 | F |
| Storage rooms, chemical | - | 1.50 | 4 | F |
| Toilets – private | 25/50 | - | 2 | E |
| Toilets – public | 50/70 | - | 2 | D |
| Woodwork shop/classrooms | _ | 0.50 | 2 | |

Notes:
a. Stands where engines are run shall have exhaust systems that directly connect to the engine exhaust and prevent escape of fumes.
b. Where combustion equipment is intended to be used on the playing surface, additional dilution ventilation, source control, or both shall be provided.
c. Exhaust shall not be required where two or more sides comprise walls that are at least 50% open to the outside.
d. Rate is per water closet, urinal, or both. Provide the higher rate where periods of heavy use are expected to occur. The lower rate shall be permitted to be used otherwise.
e. Rate is for a toilet room intended to be occupied by one person at a time. For continuous systems operation during hours of use, the lower rate shall be permitted to be used. Otherwise the higher rate shall be used.
f. See other applicable standards for exhaust rate.
g. For continuous system operation, the lower rate shall be permitted to be used. Otherwise the higher rate shall be used.
h. Rate is per showerhead

**CHANGE SIGNIFICANCE:** The extensive changes to Section 120.1 address outdoor air ventilation and indoor air quality (IAQ) with new requirements for system designs. Subsection (c) applies to the occupiable spaces in hotel/motel and nonresidential buildings. Section 120.1(c)4 aligns the Energy Code with the exhaust ventilation requirements of ASHRAE 62.1-2016. Exhaust airflow specifications are in Table 120.1-B. Exhaust makeup air can be any combination of outdoor air, recirculated air, or transfer air. [ASHRAE 62.1:6.5.1]

The exhaust ventilation requirements are new for the 2019 Energy Code. They are aligned with ASHRAE 62.1 and require certain occupancy categories to be exhausted to the outdoors. The spaces listed in Table 120.1-B are expected to have contaminants not generally found in adjacent occupied spaces. Therefore, the air supplied to the space to replace the air exhausted may be any combination of outdoor air, recirculated air, and transfer air—all of which are expected to have low or zero concentration of the pollutants generated in the listed spaces. For example, the exhaust from a toilet room can draw air from either the outdoors, adjacent spaces, or from a return air duct or plenum.

The rates specified must be provided during all periods when the space is expected to be occupied, like the requirement for ventilation air.

# 120.1(d)3

## Operation and Control Requirements for Minimum Quantities of Outdoor Air, Demand Control Ventilation

**CHANGE TYPE:** Modification and Addition

**CHANGE SUMMARY:** Demand control ventilation requirements were modified, and their scope was expanded.

**2019 CODE:**

(d) **Operation and Control Requirements for Minimum Quantities of Outdoor Air.**

[…]

3. **Required Demand Control Ventilation.** Demand ventilation controls complying with Section 120.1(d)4 are required for 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 square feet (40 square feet or less per person) if the system serving the space has one or more of the following: ~~HVAC systems with the following characteristics shall have demand ventilation controls complying with 120.1(c)4:~~

   A. ~~They have~~ an air economizer; or~~and~~

   B. modulating outside air control; or ~~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 square feet (40 square feet or less per person); and~~

   C. design outdoor airflow rate > 3,000 cfm~~They are either:~~

      ~~i. Single zone systems with any controls; or~~

      ~~ii. 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 as specified by 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 1~~2~~ to Section 120.1(c~~d~~)3:** Where space exhaust is greater than the design ventilation rate specified in Section 120.1(~~b~~c)3~~2B~~ minus 0.2 cfm per ft² of conditioned area.

**EXCEPTION 2~~3~~ to Section 120.1(c~~d~~)3:** Spaces that have processes or operations that generate dusts, fumes, mists, vapors, or gases and are not provided with local exhaust ventilation, such as indoor operation of internal combustion engines or areas designated for unvented food service preparation, daycare sickrooms, science labs, barber shops or beauty and nail salons shall not install demand control ventilation.

**EXCEPTION 3~~4~~ to Section 120.1(c~~d~~)3:** Spaces with an area of less than 150 square feet, or a design occupancy of less than 10 people as specified by Section 120.1(~~b~~c)3~~2B~~.

**~~EXCEPTION 5 to Section 120.1(c)3:~~** ~~Spaces with an area of less than 1,500 square feet complying with Section 120.1(c)5.~~

**CHANGE SIGNIFICANCE:** The changes to this section expand on the number of spaces having to comply with demand control ventilation. The analysis for this new requirement showed that it will save fan energy, as well as cooling or heating energy, by controlling the amount of air introduced to the space. Demand control ventilation had been required for single-or multizone systems with direct digital controls in spaces served by an air economizer that are classified as high density. The new requirement results in more spaces becoming subject to demand control ventilation.

Demand ventilation controls are required for spaces that have:

1. A design occupant density (or a maximum occupant load factor for egress purposes in the CBC) ≥ 25 people per 1,000 square feet (≤ 40 SF per person), and
2. A system serving the space with one or more of the following:
   - o an air economizer,
   - o modulating outside air control, or
   - o design outdoor airflow rate > 3,000 cfm.

There are now only three exceptions to the Demand Control Ventilation requirement. A 2016 exception for classrooms, call centers, and specific office spaces was removed.

# 120.1(d)5

## Operation and Control Requirements for Minimum Quantities of Outdoor Air, Occupant Sensor Ventilation Control Devices

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** The operating scheme for occupant sensor ventilation controls is deleted and now references the operating scheme in Section 110.9(b)4.

**2019 CODE:**

(d) **Operation and Control Requirements for Minimum Quantities of Outdoor Air.**

[…]

5. **Occupant Sensor Ventilation Control Devices.** When occupancy sensor ventilation devices are required by Section 120.2(e)~~3 or when meeting EXCEPTION 5 to Section 120.1(c)3~~, occupant sensors shall be used to reduce the rate of outdoor airflow when occupants are not present in accordance with the following:

   A. Occupant sensors shall meet the requirements in Section 110.9(b)4 and shall have suitable coverage and placement to detect occupants in the entire space ventilated. If ~~O~~occupant sensors controlling lighting are~~may~~ be used for ventilation, ~~as long as~~ the ventilation signal shall be~~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~~e~~d)2.

   ~~C. Within 30 minutes after being vacant for all rooms served by a zone damper on a multiple zone system, and the space temperature is between the heating and cooling setpoints, then no outside air is required and supply air shall be zero.~~

   ~~D. Within 30 minutes after being vacant for all rooms served by a single zone system, the single zone system shall cycle off the supply fan when the space temperature is between the heating and cooling setpoints.~~

   ~~E. In spaces equipped with an occupant sensor, when vacant during hours of expected occupancy and the occupied ventilation rate required by Section 120.1(b)2 is not provided, then the system or zone controls shall cycle or operate to maintain the average outdoor air rate over an averaging period of 120 minutes equal to 25percent of the rate listed in TABLE 120.1-A.~~

   ~~**Exception to 120.1(c)5:** If Demand Control Ventilation is implemented as required by Section 120.1(4).~~

**CHANGE SIGNIFICANCE:** This change removes the operating scheme for occupant sensor ventilation controls, and now references the operating

scheme in Section 110.9(b)4. The change avoids overlapping and potentially conflicting requirements.

When occupancy sensor ventilation devices are required by Section 120.2(e)3, occupant sensors must be used to reduce the rate of outdoor air flow when occupants are not present. Section 120.2(e)3 requires:

- Occupant sensing controls on conditioning systems that serve rooms with shut-off controls for indoor lighting; and
- The space must be an occupancy category that permits ventilation air to be reduced to zero when in occupied-standby mode. This is indicated with an "F" in the notes column of Table 120.1-A.

When lighting control sensors are also being used for ventilation, the ventilation signal must be independent of the lighting functions.

When a single zone damper or a single zone system serves multiple rooms, each room must have an occupancy sensor. Also, the zone is not considered vacant until all of its rooms are vacant.

# 120.1(g)

## Air Classification and Recirculation Limitations

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** New air classifications and recirculation limits for ventilation air.

**2019 CODE:**

(g) **Air Classification and Recirculation Limitations.** Air classification and recirculation limitations of air shall be based on the air classification as listed in Table 120.1-A or Table 120.1-C, and in accordance with the requirements of 120.1(g)1 through 4.

1. Class 1 Air. Recirculation or transfer of Class 1 air to any space shall be permitted; [ASHRAE 62.1:5.16.3.1]
2. Class 2 Air. Recirculation or transfer of Class 2 air shall be permitted in accordance with 120.1(g)A through 120.1(g)E:
   - A. Recirculation of Class 2 air within the space of origin shall be permitted [ASHRAE 62.1:5.16.3.2.1]:
   - B. Recirculation or transfer of Class 2 to other Class 2 or Class 3 spaces shall be permitted, provided that the other spaces are used for the same or similar purpose or task and involve the same or similar pollutant sources as the Class 2 space [ASHRAE 62.1:5.16.3.2.2]; or
   - C. Transfer of Class 2 air to toilet rooms [ASHRAE 62.1:5.16.3.2.3]; or
   - D. Recirculation or transfer of Class 2 air to Class 4 spaces [ASHRAE 62.1:5.16.3.2.4]; or
   - E. Class 2 air shall not be recirculated or transferred to Class 1 spaces. [ASHRAE 62.1:5.16.3.2.5]

   **EXCEPTION to Section 120.1(g)2E:** When using any energy recovery device, recirculation from leakage, carryover, or transfer from the exhaust side of the energy recovery device is permitted. Recirculated Class 2 air shall not exceed 10% of the outdoor air intake flow.
3. Class 3 Air. Recirculation or transfer of Class 3 air shall be permitted in accordance with 120.1(g)3A and B:
   - A. Recirculation of Class 3 air within the space of origin shall be permitted. [ASHRAE 62.1:5.16.3.3.1]
   - B. Class 3 air shall not be recirculated or transferred to any other space. [ASHRAE 62.1:5.16.3.3.2].

   **EXCEPTION to Section 120.1(g)3B:** When using any energy recovery device, recirculation from leakage, carryover, or transfer from the exhaust side of the energy recovery device is permitted. Recirculated Class 3 air shall not exceed 5% of the outdoor air intake flow.
4. Class 4 Air. Class 4 air shall not be recirculated or transferred to any space or recirculated within the space of origin. [ASHRAE 62.1:5.16.3.4]
5. Ancillary spaces. Redesignation of Class 1 air to Class 2 air shall be permitted for Class 1 spaces that are ancillary to Class 2 spaces. [ASHRAE 62.1:5.16.2.3]

6. Transfer. A mixture of air that has been transferred through or returned form spaces or locations with different air classes shall be redesignated with the highest classification among the air classes mixed. [ASHRAE 62.1:5.16.2.2]

7. Classification. Air leaving each space or location shall be designated at an expected air-quality classification not less than that shown in Tables 120.1-A, 120.1-B or 120.1-C. Air leaving spaces or locations that are not listed in Tables 120.1-A, 120.1-B or 120.1-C shall be designated with the same classification as air from the most similar space or location listed in terms of occupant activities and building construction.

[…]

**TABLE 120.1-C Airstreams or Sources [ASHRAE 62.1: Table 5.16.1]**

| Description | Air Class |
|---|---|
| Diazo printing equipment discharge | 4 |
| Commercial kitchen grease hoods | 4 |
| Commercial kitchen other than grease | 3 |
| Laboratory hoods | 4[a] |
| Hydraulic elevator machine room | 2 |

a. Air Class 4 unless determined otherwise by the Environmental Health and Safety professional responsible to the owner or to the owner's designee.

**CHANGE SIGNIFICANCE:** This change adds air classifications and recirculation limits for ventilation air. Previously, the Energy Code did not give direction on these two concepts, although they may have a significant impact on indoor air quality. They are present in ASHRAE standards that were incorporated by reference but not directly stated in the Energy Code. The new subsection helps designers by clarifying the Energy Code requirements for ventilation systems.

Based on the air class, air can be transferred to other spaces in the building or must be exhausted. The new requirement specifies air classifications for occupancy categories in Table 120.1-A (Minimum Ventilation Rates). Air classifications are also included in Table 120.1-C (Airstreams or Sources).

The exceptions to (g)2 and (g)3 permit a small amount of transfer air to facilitate heat recovery. They were added to avoid restricting heat recovery devices or systems, and their associated energy efficiency benefits.

# 120.2(b)3

## Criteria for Zonal Thermostatic Controls Demand Shed Control Exceptions

**TYPE:** Modification

**CHANGE SUMMARY:** An exception is added for healthcare facilities.

**2019 CODE:**

(b) **Criteria for Zonal Thermostatic Controls.** The individual thermostatic controls required by Section 120.2(a) shall meet the following requirements as applicable:

[…]

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 deadband 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 1 to Section 120.2(b)3:** Systems with thermostats that require manual changeover between heating and cooling modes.

   **EXCEPTION 2 to Section 120.2(b)3:** Systems serving healthcare facilities.

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to add an exception for systems serving healthcare facilities. This is necessary because the dead band may need to be smaller than 5°F in a healthcare facility.

# 120.2(b)4

## Criteria for Zonal Thermostatic Controls, Thermostatic Controls

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** The purpose of the change to this section is to correct a reference to requirements in Reference Joint Appendix JA5 (JA5) to instead refer to Section 110.12, and to exempt systems serving healthcare facilities.

**2019 CODE:**

(b) **Criteria for Zonal Thermostatic Controls.** The individual thermostatic controls required by Section 120.2(a) shall meet the following requirements as applicable:

[…]

4. Thermostatic controls for all single zone air conditioners and heat pumps, shall comply with the requirements of Sections 110.2(c) and ~~Reference Joint Appendix JA5~~110.12(a) ~~or~~and, if equipped with DDC to the Zone level, with the Automatic Demand Shed Controls of Section ~~120.2(h)~~110.12(b).

**EXCEPTION 1 to Section 120.2(b)4:** Systems serving exempt process loads that must have constant temperatures to prevent degradation of materials, a process, plants or animals.

**EXCEPTION 2 to Section 120.2(b)4:** Package terminal air conditioners, package terminal heat pumps, room air conditioners, and room air-conditioner heat pumps.

**EXCEPTION 3 to Section 120.2(b)4:** Systems serving healthcare facilities.

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to correct a reference to requirements in Reference Joint Appendix JA5 (JA5) to instead refer to Section 110.12. This is necessary because JA5 has been revised, and the necessary requirements are now located in Section 110.12. The changes in JA5 were made to remove requirements that are redundant with Section 110.12, including OpenADR2.0a and 2.0b as incorporated by reference into Section 110.12, and to clarify and reorganize the remaining language. An exception for systems serving healthcare facilities is added because healthcare facilities are exempt from all demand management sections of the code in order to ensure the health and safety of patients.

# 120.2(c)

## Hotel/Motel Guest Room and High-rise Residential Dwelling Units

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** The change improves the clarity of the requirement by referring directly to 110.2(c) rather than indirectly via section 150.0(i).

**2019 CODE:**

(c) **Hotel/Motel Guest Room and High-rise Residential Dwelling Unit Thermostats.**

1. Hotel/motel guest room thermostats shall:
   A. Have numeric temperature setpoints in °F and °C; and
   B. Have setpoint stops, which are accessible only to authorized personnel, such that guest room occupants cannot adjust the setpoint more than ±5°F (±3°C); and
   C. Meet the requirements of Section 110.2(c)~~150.0(i)~~.

   **EXCEPTION to Section 120.2(c)1:** Thermostats that are integrated into the room heating and cooling equipment.
2. High-rise residential dwelling unit thermostats shall meet the requirements of Section 110.2(c)~~150.0(i)~~.

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section are to update references to thermostat requirements to refer to Section 110.2(c) rather than Section 150.0(i). Section 150.0(i) itself only specifies compliance with Section 110.2(c), thus it improves the clarity of the requirement to refer directly to Section 110.2(c) rather than indirectly via Section 150.0(i). The changes are necessary to improve Part 6's clarity and consistency.

# 120.2(e)3

## Shut-off and Reset Controls for Space-conditioning Systems, Occupancy Sensing Zone Controls

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Changes were made to the applicability of the space-conditioning occupancy sensor zonal control requirements, and to how they function.

**2019 CODE:**

(e) **Shut-off and Reset Controls for Space-conditioning Systems.** Each space-conditioning system shall be installed with controls that comply with the following:

[...]

3. Occupancy Sensing Zone Controls. Space conditioning systems serving room(s) that are required to have occupant sensing controls in accordance with Section 130.1(c), and where the Table 120.1-A occupancy category permits ventilation air to be reduced to zero when the space is in occupied-standby mode, shall meet the following:~~Multipurpose room less than 1000 square feet, classrooms greater than 750 square feetand conference, convention, auditorium and meeting center rooms greater than 750 square feet that do not have processes or operations that generate dusts, fumes, vapors or gasses shall be equipped with occupant sensor(s) to accomplish the following during unoccupied periods:~~

   A. The zone shall be placed in occupied standby mode when all room(s) served by the zone are unoccupied for more than 5 minutes; and

   B. During occupied standby mode.

      i. Automatically set up the operating cooling temperature set point by 2°F or more and set back the operating heating temperature set point by 2°~~°~~F or more; ~~and~~or

      ii. For multiple zone systems with Direct Digital Controls (DDC) to the zone level, set up the operating cooling temperature setpoint by 0.5°F or more and set back the operating heating temperature setpoint by 0.5°F or more.

   C. During occupied-standby mode, all airflow to the zone shall be shut off whenever the space temperature is between the active heating and cooling setpoints.

   ~~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 Sections 120.2(e)1, 2, and 3:** 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 Sections 120.2(e)1, 2, and 3:** 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 2~~3~~ to Sections 120.2(e)1, 2, and 3:** Systems with full load demands of 2 kW or less, if they have a readily accessible manual shut-off switch.

**EXCEPTION 3~~4~~ to Sections 120.2(e)1 and 2:** Systems serving hotel/motel guest rooms, if they have a readily accessible manual shut-off switch.

~~**EXCEPTION 5 to Sections 120.2(e)3:**. If Demand Control Ventilation is implemented as required by Section 120.1(c)3 and 120.1(c)(4).~~

**CHANGE SIGNIFICANCE:** For space types identified as eligible to be in occupied standby mode according to the new Table 120.1-A, and for which an occupancy sensor control is used to satisfy the lighting control requirement, the ventilation provided to the zone may be reduced to zero when the zone is unoccupied and within the system deadband. Changes to this section also include the elimination of two exceptions, the first is now irrelevant due to Section 120.1(c)3 and 4 being deleted, and the second being unnecessary since continuous operation is already exempted from Sections 120.2(e)1, 2, and 3.

The analysis for this new requirement showed that it will save fan energy and cooling or heating energy by controlling the amount of air introduced to the space. This change is necessary to achieve savings. The changes to the exceptions were intended to simplify the code language.

# 120.2(f)

## Dampers for Air Supply and Exhaust Equipment

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Changes were made to simplify code language for clarity.

**2019 CODE:**

(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 120.2(f):** ~~Where it can be demonstrated to the satisfaction of the enforcing agency that the equipment~~Equipment that serves an area that must operate continuously.

**EXCEPTION 2 to Section 120.2(f):** Gravity and other nonelectrical equipment that has readily accessible manual damper controls.

**EXCEPTION 3 to Section 120.2(f):** At combustion air intakes and shaft vents.

**EXCEPTION 4 to Section 120.2(f):** Where prohibited by other provisions of law.

**CHANGE SIGNIFICANCE:** The purpose of the change to the exception to this section is to simplify the code language. This change clarifies the exception without materially altering the requirements.

# 120.2(h)

## Automatic Demand Shed Controls

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** The requirements of this section have been relocated to Section 110.12.

**2019 CODE:**

(h) **Automatic Demand Shed Controls.** See Section 110.12 for requirements for 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 Sections 120.2(h)1 and 120.2(h)2, for non-critical zones during the demand response period.~~

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to relocate its requirements to Section 110.12 as a part of consolidating all of the demand response and demand management requirements in a single section. The change clarifies without materially altering the requirements.

# 120.2(i)

## Economizer Fault Detection and Diagnostics (FDD)

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** The changes to this section extend the requirements for FDD to all cooling systems with an economizer and a cooling capacity over 4.5 tons.

**2019 CODE:**

(i) **Economizer Fault Detection and Diagnostics (FDD).** All newly installed ~~air-cooled packaged direct-expansion units with an~~ air handlers with a mechanical cooling capacity greater than 54,000 Btu/hr and~~with~~ an installed air economizer shall include a stand-alone or integrated Fault Detection and Diagnostics (FDD) system in accordance with Subsections 120.2(i)1 through 120.2(i)8.

1. The following temperature sensors shall be permanently installed to monitor system operation: outside air, supply air, and when required for differential economizer operation, a return air sensor; and
2. Temperature sensors shall have an accuracy of ±2°F over the range of 40°F to 80°F; and
3. The controller shall have the capability of displaying the value of each sensor; and
4. The controller shall provide system status by indicating the following conditions:
   A. Free cooling available;
   B. Economizer enabled;
   C. Compressor enabled;
   D. Heating enabled, if the system is capable of heating; and
   E. Mixed air low limit cycle active.
5. The unit controller shall allow manual~~ly~~ initiation of~~initiate~~ each operating mode so that the operation of cooling systems~~compressors~~, economizers, fans, and heating systems can be independently tested and verified; and
6. Faults shall be reported in one of the following ways:
   A. Reported to an Energy Management Control System regularly monitored by facility personnel.
   B. Annunciated locally on one or more zone thermostats, or a device within five (5) feet of zone thermostat(s), clearly visible, at eye level, and meeting the following requirements:
      i. On the thermostat, device, or an adjacent written sign, display instructions to contact appropriate building personnel or an HVAC technician; and
      ii. In buildings with multiple tenants, the annunciation shall either be within property management offices or in a common space accessible by the property or building manager.
   C. Reported to a fault management application which automatically provides notification of the fault to remote HVAC service provider.

7. The FDD system shall detect the following faults:
   A. Air temperature sensor failure/fault;
   B. Not economizing when it should;
   C. Economizing when it should not;
   D. Damper not modulating; and
   E. Excess outdoor air.
8. The FDD System shall be certified by the Energy Commission as meeting requirements of Sections 120.2(i)1 through 120.2(i)7 in accordance with Section 110.0 and JA6.3.

   **EXCEPTION to 120.2(i)8:** FDD algorithms based in Direct Digital Control systems are not required to be certified to the Energy Commission.

**CHANGE SIGNIFICANCE:** The changes to this section expand existing Fault Detection and Diagnostic (FDD) requirements for air cooled packaged direct expansion units to all mechanical cooling systems over 4.5 tons with an air economizer.

An exception was added to exempt FDD algorithms based on direct digital control systems from the certification requirements of the Energy Code. In the analysis for expanding this requirement to all cooling system types, it was identified that certain FDD's have several people responsible for the operation of the FDD. The installing contractor, control contractor, FDD manufacturer, or another person may be responsible for the control algorithms, and requiring certification of the control algorithms was not feasible, therefore, the exception was necessary.

Other changes to this section are to simplify phrasing and correct an error in section numbering and do not alter the requirements.

# 120.2(j)

## Direct Digital Controls (DDC)

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** The primary change to this section updates section references that have changed due to updates to the Energy Code.

**2019 CODE:**

(j) **Direct Digital Controls (DDC).** Direct Digital Controls to the zone shall be provided as specified by Table 120.2-A.

The provided DDC system shall meet the control logic requirements of Sections 120.1(ed) and 120.2(h), and be capable of the following:

1. Monitoring zone and system demand for fan pressure, pump pressure, heating and cooling;
2. ~~Transfering~~Transferring zone and system demand information from zones to air distribution system controllers and from air distribution systems to heating and cooling plant controllers;
3. Automatically detecting the zones and systems that may be excessively driving the reset logic and generate an alarm or other indication to the system operator;
4. Readily allow operator removal of zones(s) from the reset algorithm;
5. For new buildings, trending and graphically displaying input and output points; and
6. Resetting heating and cooling setpoints in all noncritical zones upon receipt of a signal from a centralized contact or software point as described in Section 120.2(h).

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section is to update a reference to Section 120.1 to account for amendments to Section 120.1. Other changes are made to correct spelling and punctuation. These changes clarify without materially altering the requirements.

# 120.2(k)

## Optimum Start/Stop Controls

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** An exception is added to this section for systems that must operate continuously.

**2019 CODE:**

(k) **Optimum Start/Stop Controls.** Space conditioning systems with DDC to the zone level shall have optimum start/stop controls. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint, the outdoor air temperature, and the amount of time prior to scheduled occupancy. Mass radiant floor slab systems shall incorporate floor temperature onto the optimum start algorithm.

**EXCEPTION to Section 120.2(k):** Systems that must operate continuously.

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to add an exception for continuously operating equipment. Continuously operating equipment never stops, therefore requirements relating to stopping and restarting are unnecessary. This exception was added to avoid applying this section's requirement where it would serve no purpose and provide no benefit.

# 120.3

## Requirements for Pipe Insulation
## Exception 3 to 120.3(a)
## General Requirements

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** A redundant exception to the pipe insulation requirements of Section 120.3 was removed for clarity.

**2019 CODE:**

~~**EXCEPTION 3 to Section 120.3:** Gas piping, cold domestic water piping, condensate drains, roof drains, vents, or waste piping.~~

**CHANGE SIGNIFICANCE:** The piping insulation requirements in Section 120.3 are for specific types of piping which do not include the piping types called out in the exception. As none of the piping in Exception 3 have any requirements in Section 120.3, the exception is not needed.

# 120.3(a)
## General Requirements

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Restructured and clarified which pipes are subject to the pipe insulation requirements.

**2019 CODE:**

(a) **General Requirements.** The piping conditions listed below for space-conditioning and service water-heating systems with fluid normal operating temperatures listed in TABLE 120.3-A, shall have at least the amount of insulation specified in Subsection (c):

1. **Space Cooling Systems.** All refrigerant suction, chilled water, ~~and brine lines~~and brine fluid distribution systems.
2. **Space Heating Systems.** All refrigerant, steam, steam condensate and hot water ~~lines~~fluid distribution systems.
3. **Service water-heating systems.**
   A. Recirculating system piping, including the supply and return piping ~~of~~ to the water heater.
   B. The first 8 feet of hot and cold outlet piping, including piping between a storage tank and a heat trap, for a nonrecirculating storage system.
   ~~C. The inlet pipe between the storage tank and a heat trap in a nonrecirculating storage system. D~~C. Pipes that are externally heated.

Insulation conductivity shall be determined in accordance with ASTM C335 at the mean temperature listed in TABLE 120.3-A, and shall be rounded to the nearest 1/100 Btu-inch per hour per square foot per °F. Fluid distribution systems include all elements that are in series with the fluid flow, such as pipes, pumps, valves, strainers, coil u-bends, and air separators, but not including elements that are not in series with the fluid flow, such as expansion tanks, fill lines, chemical feeders, and drains.

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section are to clarify that the insulation requirements of Section 120.3 are minimum requirements, and that the amount of insulation is based on normal operating temperatures and not temperatures that may theoretically occur under abnormal circumstances, and to clarify an ambiguity regarding refrigerant lines for heat pump space conditioning equipment when that equipment is operating exclusively in a heating mode. The change is necessary to preclude this unintended reading of this section's requirements. These changes clarify without materially altering the requirements.

# 120.3(b)

## Insulation Protection

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** These changes merge requirements for residential and nonresidential pipe insulation, clarify insulation protection requirements, and prevent the use of adhesive tape as a weather protection cover.

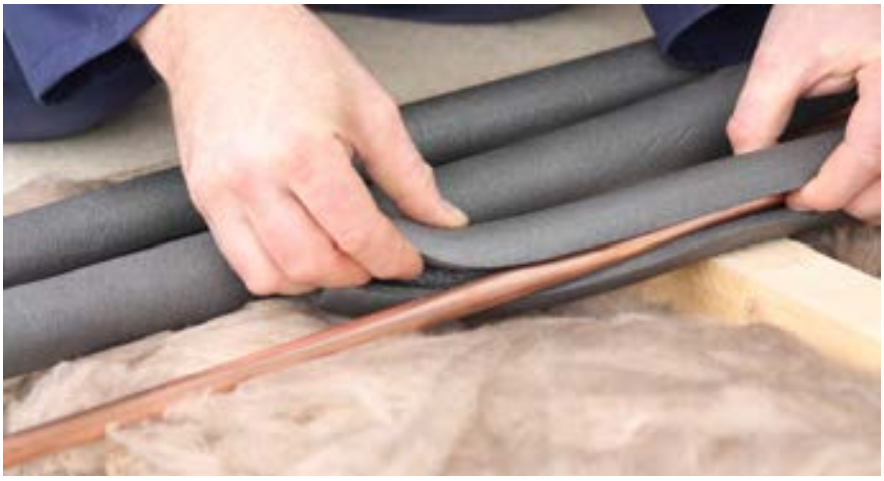
**2019 CODE:**

(b) **Insulation Protection.** Pipe Insulation shall be protected from damage, ~~including that~~ due to sunlight, moisture, equipment maintenance, and wind.~~,~~ Protection shall, at minimum, include~~ing but not limited to,~~ the following:

1. Pipe ~~I~~insulation exposed to weather shall be ~~installed with~~protected by a cover suitable for outdoor service. The cover shall be water retardant and provides shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be used to provide this protection.
2. Pipe ~~I~~insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include, or be protected by, ~~have~~ a Class I or Class II vapor retarder. All penetrations and joints ~~of which~~ shall be sealed.
3. Pipe insulation buried below grade must be installed in a water proof and non-crushable casing or sleeve.

**CHANGE SIGNIFICANCE:** The purpose of these changes are to standardize insulation protection requirements between residential and nonresidential buildings, clarifying that if the outer surface of the insulation provides the required protection that an additional cover is not needed, and to make nonsubstantive grammatical improvements to the language. The changes have the substantive effect of prohibiting the use of adhesive tape as a weather protecting cover, and of requiring that pipe insulation buried below grade to be installed in a waterproof and noncrushable casing or sleeve for both residential and nonresidential applications.

The 2016 Energy Code language could have been misinterpreted as requiring a separate weather protecting cover, even when either the insulation itself or the insulation integrates a protective cover that provides the required level of protection. The language has been clarified to show that a redundant cover is not necessary when the insulation incorporates the proper protection. These changes are necessary to ensure that pipe insulation is installed with protective features that ensure and preserve its long-term performance, and to create consistency between residential and nonresidential requirements.



Getty Images

Pipe insulation – When exposed to weather, pipe insulation must be protected as described in Section 120.3(b) of the Energy Code.

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** Changes to Table 120.3-A have been made to clarify existing requirements and simplify insulation material selection.

**2019 CODE:**

# Table 120.3-A

## Pipe Insulation Thickness

**TABLE 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)~~ | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | ~~< 1~~ | ~~1 to <1.5~~ | | ~~1.5 to < 4~~ | ~~4 to < 8~~ | ~~8 and larger~~ | |
| | | | ~~INSULATION THICKNESS REQUIRED (in inches)~~ | | | | | | |
| ~~Space heating, Hot Water systems (steam, steam condensate and hot water) and 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 350~~ | ~~0.32-0.34~~ | ~~250~~ | ~~4.5~~ | | ~~5.0~~ | | ~~5.0~~ | ~~5.0~~ | ~~5.0~~ |
| ~~251-350~~ | ~~0.29-0.32~~ | ~~200~~ | ~~3.0~~ | | ~~4.0~~ | | ~~4.5~~ | ~~4.5~~ | ~~4.5~~ |
| ~~201-250~~ | ~~0.27-0.30~~ | ~~150~~ | ~~2.5~~ | | ~~2.5~~ | | ~~2.5~~ | ~~3.0~~ | ~~3.0~~ |
| ~~141-200~~ | ~~0.25-0.29~~ | ~~125~~ | ~~1.5~~ | | ~~1.5~~ | | ~~2.0~~ | ~~2.0~~ | ~~2.0~~ |
| ~~105-140~~ | ~~0.22-0.28~~ | ~~100~~ | ~~1.0~~ | | ~~1.5~~ | | ~~1.5~~ | ~~1.5~~ | ~~1.5~~ |
| ~~Space cooling systems (chilled water, refrigerant and brine)~~ | | | | | | | | | |
| ~~40-60~~ | ~~0.21-0.27~~ | ~~75~~ | ~~Nonres 0.5~~ | ~~Res 0.75~~ | ~~Nonres 0.5~~ | ~~Res 0.75~~ | ~~1.0~~ | ~~1.0~~ | ~~1.0~~ |
| ~~Below 40~~ | ~~0.20-0.26~~ | ~~50~~ | ~~1.0~~ | | ~~1.5~~ | | ~~1.5~~ | ~~1.5~~ | ~~1.5~~ |

## TABLE 120.3-A Pipe Insulation Thickness

| FLUID OPERATING 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) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | < 1 | 1 to < 1.5 | 1.5 to < 4 | 4 to < 8 | 8 and larger |
| | | | | INSULATION THICKNESS REQUIRED (in inches or *R*-value) | | | | |
| **Space heating, Service Water Heating Systems (Steam, Steam Condensate Refrigerant, Space Heating, Service Hot Water)** | | | | | | | | |
| Above 350 | 0.32–0.34 | 250 | Inches | 4.5 | 5.0 | 5.0 | 5.0 | 5.0 |
| | | | *R*-value | R 37 | R 41 | R 37 | R 27 | R 23 |
| 251–350 | 0.29–0.32 | 200 | Inches | 3.0 | 4.0 | 4.5 | 4.5 | 4.5 |
| | | | *R*-value | R 24 | R 34 | R 35 | R 26 | R 22 |
| 201–250 | 0.27–0.30 | 150 | Inches | 2.5 | 2.5 | 2.5 | 3.0 | 3.0 |
| | | | *R*-value | R 21 | R 20 | R 17.5 | R 17 | R 14.5 |
| 141–200 | 0.25–0.29 | 125 | Inches | 1.5 | 1.5 | 2.0 | 2.0 | 2.0 |
| | | | *R*-value | R 11.5 | R 11 | R 14 | R 11 | R 10 |
| 105–140 | 0.22–0.28 | 100 | Inches | 1.0 | 1.5 | 1.5 | 1.5 | 1.5 |
| | | | *R*-value | R 7.7 | R 12.5 | R 11 | R 9 | R 8 |
| | | | | Nominal Pipe Diameter (inches) | | | | |
| | | | | < 1 | 1 to < 1.5 | 1.5 to < 4 | 4 to < 8 | 8 and larger |
| **Space cooling systems (chilled water, refrigerant and brine)** | | | | Minimum Pipe Insulation Required (Thickness in inches or R-value)[1] | | | | |
| 40–60 | 0.21–0.27 | 75 | Inches | Nonres 0.5 / Res 0.75 | | Nonres 0.5 / Res 0.75 | | 1.0 | 1.0 | 1.0 |
| | | | *R*-value | Nonres R 3 / Res R 6 | | Nonres R 3 / Res R 5 | | R 7 | R 6 | R 5 |
| Below 40 | 0.20–0.26 | 50 | Inches | 1.0 | | 1.5 | | 1.5 | 1.5 | 1.5 |
| | | | *R*-value | R 8.5 | | R 14 | | R 12 | R 10 | R 9 |

Footnote to TABLE 120.3-A:

1. These thickness are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.

**CHANGE SIGNIFICANCE:** Language has been added to Table 120.3-A to clarify that the listed thickness and *R*-values are minimum requirements. *R*-values have been added to the table to allow materials which are listed by their *R*-values to be selected for the needed application without having to calculate the required thickness based on the rated thermal conductivity. The listed *R*-values correspond to the listed minimum conductivities, so there is no change in the efficiency requirements.

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** An exception to Section 120.4 for healthcare facilities is added.

**2019 CODE:**

Nonresidential, high-rise residential, and hotel/motel buildings shall comply with the applicable requirements of Sections 120.4(a) through 120.4(f).

**EXCEPTION to Section 120.4:** Systems serving healthcare facilities shall comply with the applicable requirements of the *California Mechanical Code*.

**CHANGE SIGNIFICANCE:** The purpose of this change is to exempt systems serving healthcare facilities from all requirements of Section 120.4. This change is necessary to prevent conflict between the requirements of the Mechanical Code and Section 120.4 of the Energy Code by incorporating a reference to the Mechanical Code sections that apply to healthcare facilities.

# 120.4

## Requirements for Air Distribution System Ducts and Plenums Exception to Section 120.4 General Requirements

# 120.4(a)

## CMC Compliance

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Unnecessary verbiage relating to air distribution duct systems was removed to simplify the code language.

**2019 CODE:**

(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 CMC Sections 601.0, 602.0, 603.0, 604.0, 605.0, and ANSI/SMACNA-006-2006 HVAC *Duct Construction Standards Metal and Flexible*, 3rd Edition, 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 crawl space; 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 605.0)~~ or be enclosed in directly conditioned space.

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section are to remove unnecessary verbiage, including a parenthetical statement that has no regulatory effect. These changes clarify without materially altering the requirements and are necessary to improve the clarity of the Energy Code.

# 120.5

## Requirements for Nonresidential Mechanical System Acceptance Exception to Section 120.5(a) General Requirements

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** An exception to Section 120.4 for healthcare facilities is added.

**2019 CODE:**

Nonresidential, high-rise residential, and hotel/motel buildings shall comply with the applicable requirements of Sections 120.4(a) through 120.4(f).

**EXCEPTION to Section 120.5:** Systems serving healthcare facilities.

**CHANGE SIGNIFICANCE:** The purpose of this exception is to exempt licensed healthcare facilities from all of the requirements of Section 120.5. This exception is necessary because licensed healthcare facilities are being brought into the scope of the Energy Code for the first time, but this section has been identified as potentially not cost effective when applied to a healthcare facility. Licensed healthcare facilities are permitted and built under the close supervision and continuous inspection of the Office of Statewide Health Planning and Development (OSHPD), and the requirements of this section would likely duplicate existing testing and certification requirements under OSHPD. Future code cycles may remove this exception based on more detailed analysis, partial exceptions tailored specifically for healthcare facilities, or both.

# 120.5(a)18

## Acceptance Testing, Occupant Sensing Zone Controls

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** A new occupant sensing zone controls Acceptance Test has been added to the mandatory mechanical system acceptance test requirements.

**2019 CODE:**

(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:

[…]

18. Occupant *Sensing Zone Controls* shall be tested in accordance with NA7.5.17.

**CHANGE SIGNIFICANCE:** The purpose of this change is to add a reference to a new Acceptance Test. The new acceptance test will verify the occupant sensors and ventilation controls comply with the intent of the new occupant sensing zone control requirement of Section 120.2(e)3. This acceptance testing is vital to ensure the ventilation controls scheme correctly delivers and reduces ventilation to the zone, which has both energy savings and indoor air quality implications.

# 120.6(a)

## Mandatory Requirements for Refrigerated Warehouses

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Clarification of the code language is needed to remove ambiguity about the size of a refrigerated space that triggers the requirements in 120.6(a) and when each requirement is applicable.

**2019 CODE:**

(a) **Mandatory Requirements for Refrigerated Warehouses**

Refrigerated warehouses that are greater than or equal to 3,000 square feet and refrigerated spaces with a sum total of 3,000 square feet or more that are served by the same refrigeration system 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).~~

[…]

**CHANGE SIGNIFICANCE:** The 2016 Energy Code language was unclear about the size that a refrigerated space needed to be in order to trigger the refrigerated warehouse requirements. There are two scenarios where the refrigerated warehouse requirements are triggered. First, when a single refrigerated space is 3,000 square feet or larger, the space is considered a refrigerated warehouse. Second, if there is more than one space served by a single refrigeration system, and the combined floor area of those spaces served by that system are 3,000 square feet or larger, the collective spaces are considered a refrigerated warehouse. If the thresholds are met to be a refrigerated warehouse, all of Section 120.6(a) is applicable to the space(s). If the refrigerated space, or spaces, do not meet the size requirements, the space is not a refrigerated warehouse. Instead, these spaces are considered a walk-in cooler or freezer, and none of the requirements in Section 120.6(a) are applicable. Walk-in coolers and freezers are covered under the federal Department of Energy requirements and the California Appliance Efficiency Regulations.

# 120.6(a)4

## Mandatory Requirements for Refrigerated Warehouses, Condensers

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Requirements have been added to allow the use of adiabatic condensers for refrigerated warehouse refrigeration systems.

**2019 CODE:**

(a) **Mandatory Requirements for Refrigerated Warehouses**

[…]

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

A. Design saturated condensing temperatures for evaporative-cooled condensers and water-cooled condensers served by fluid coolers or cooling towers shall be less than or equal to:

i. The design wetbulb temperature plus 20°F in locations where the design wetbulb temperature is less than or equal to 76°F;

ii. The design wetbulb temperature plus 19°F in locations where the design wetbulb temperature is between 76°F and 78°F; or

iii. The design wetbulb temperature plus 18°F in locations were the design wetbulb temperature is greater than or equal to 78°F.

**EXCEPTION 1 to Section 120.6(a)4A:** Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling or freezing, or process refrigeration cooling for other than a refrigerated space.

B. Design saturated condensing temperatures for air-cooled condensers shall be less than or equal to:

i. ~~t~~The design drybulb temperature plus 10°F for systems serving freezers;

ii. ~~and shall be less than or equal to t~~The design drybulb temperature plus 15°F for systems serving coolers.

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

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

C. The saturated condensing temperature necessary for adiabatic condensers to reject the design total heat of rejection of a refrigeration system assuming dry mode performance shall be less than or equal to:

i. The design drybulb temperature plus 20°F for systems serving freezers;

ii. The design drybulb temperature plus 30°F for systems serving coolers.

**EXCEPTION 1 to Section 120.6(a)4C:** 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.

D. All condenser fans for air-cooled condensers, evaporative-cooled condensers, adiabatic condensers, gas coolers, air or water fluid coolers or cooling towers ~~or fans on cooling towers or fluid coolers~~ shall be continuously variable speed, ~~and the condensing temperature control system shall control~~ with the speed of all fans serving a common condenser high side controlled in unison. ~~The minimum condensing temperature setpoint shall be less than or equal to 70°F.~~

~~D. All condenser fans for air-cooled condensers shall be continuously variable speed and the condensing temperature or pressure control system shall control the speed of all condenser fans serving a common condenser high side in unison. The minimum condensing temperature setpoint shall be less than or equal to 70°F.~~

E. The minimum condensing temperature setpoint shall be less than or equal to 70°F for air-cooled condensers, evaporative-cooled condensers, adiabatic condensers, gas coolers, air or water-cooled fluid coolers or cooling towers.

F~~E.~~ Condensing temperature reset. The condensing temperature set point of systems served by air-cooled condensers shall be reset in response to ambient drybulb temperature. The condensing temperature set point of systems served by evaporative-cooled condensers or water-cooled condensers (via cooling towers or fluid coolers) shall be reset in response to ambient wetbulb temperatures. The condensing temperature set point for systems served by adiabatic condensers shall be reset in response to ambient drybulb temperature while operating in dry mode.

**EXCEPTION 1 to Section 120.6(a)4E~~F~~:** Condensing temperature control strategies approved by the Executive Director that have been demonstrated to provide at least equal energy savings.

**EXCEPTION 2 to Section 120.6(a)4F:** Systems served by adiabatic condensers in Climate Zones 1, 3, 5, 12, 14 and 16.

~~F~~G. 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.

**EXCEPTION to Section 120.6(a)4G:** Adiabatic condensers with ammonia as refrigerant.

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

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

**EXCEPTION to Section 120.6(a)4A, 4B, 4C, 4E, 4F and 4G:** Transcritical CO2 refrigeration systems.

**TABLE 120.6-B Fan-Powered Condensers–Minimum Efficiency Requirements**

| CONDENSER TYPE | REFRIGERANT TYPE | MINIMUM EFFICIENCY | RATING CONDITION |
|---|---|---|---|
| Outdoor Evaporative-Cooled with THR Capacity > 8,000 MBH | All | 350 Btuh/Watt | 100°F Saturated Condensing Temperature (SCT), 70°F Outdoor Wetbulb Temperature |
| Outdoor Evaporative-Cooled with THR Capacity < 8,000 MBH and Indoor Evaporative-Cooled | All | 160 Btuh/Watt | |
| Outdoor Air-Cooled | Ammonia | 75 Btuh/Watt | 105°F Saturated Condensing Temperature (SCT), 95°F Outdoor Drybulb Temperature |
| | Halocarbon | 65 Btuh/Watt | |
| Adiabatic Dry Mode | Halocarbon | 45 Btuh/Watt | 105°F Saturated Condensing Temperature (SCT), 95°F Outdoor Drybulb Temperature |
| Indoor Air-Cooled | All | Exempt | |

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section are to incorporate appropriate standards for adiabatic condenser equipment. Establishing efficiency standards for adiabatic equipment is necessary to prevent the Energy Code from inadvertently restricting the use of such equipment in California. This will broaden the options for energy efficient equipment available to California builders.

Adiabatic condensers function like a hybrid between evaporative and dry condensers with the use of cooling pads. Running water over the cooling pads and drawing air through the pads reduces the ambient dry bulb of the incoming air, which allows for greater system heat rejection. These systems are most effective in hot, dry climates, and use water only when ambient temperatures and system demand require it. Adiabatic cooling systems offer an energy efficient solution that provides dramatic water savings relative to traditional evaporative systems.

# 120.6(b)

## Mandatory Requirements for Commercial Refrigeration

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Language is added to appropriately scope the application of this section to equipment that is not subject to federal appliance efficiency requirements, and to allow and regulate additional energy efficient technologies.

**2019 CODE:**

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

Retail food stores with 8,000 square feet or more of conditioned floor area, and that utilize either: refrigerated display cases, or walk-in coolers or freezers ~~connected to remote compressor units or condensing units,~~ shall meet all applicable State and federal appliance and equipment standards consistent with Section 110.0 and 110.1 or, for equipment not subject to such standards, 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, adiabatic condensers, gas coolers, 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 refrigeration system condenser controls for systems with adiabatic condensers shall use variable setpoint control logic to reset the condensing temperature setpoint in response to ambient drybulb temperature while operating in dry mode.

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

**EXCEPTION 2 to Section 120.6(b)1D:** Systems served by adiabatic condensers in Climate Zone 16.

   E. The saturated condensing temperature necessary for adiabatic condensers to reject the design total heat of rejection of a refrigeration system assuming dry mode performance shall be less than or equal to:
      i. The design drybulb temperature plus 20°F for systems serving freezers;

ii. The design drybulb temperature plus 30°F for systems serving coolers.

FD. The minimum condensing temperature setpoint shall be less than or equal to 70°F.

GE. Fan-powered condensers shall meet the specific efficiency requirements listed in Table 120.6-C.

**TABLE 120.6-C Fan-Powered Condensers–Specific Efficiency Requirements**

| CONDENSER TYPE | MINIMUM SPECIFIC EFFICIENCY[a] | RATING CONDITION |
|---|---|---|
| Evaporative-Cooled | 160 Btuh/W | 100°F Saturated Condensing Temperature (SCT), 70°F Entering Wetbulb Temperature |
| Air-Cooled | 65 Btuh/W | 105°F Saturated Condensing Temperature (SCT), 95°F Entering Drybulb Temperature |
| Adiabatic Dry Mode | 45 Btuh/W (halocarbon) | 105°F Saturated Condensing Temperature (SCT), 95°F Entering Drybulb Temperature |

a. See Section 100.1 for definition of condenser specific efficiency.

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

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

**EXCEPTION 3 to Section 120.6(b)1EG:** E1xisting condensers that are reused for an addition or alteration.

**CHANGE SIGNIFICANCE:** The addition of the words "shall meet all applicable State and federal appliance and equipment standards" is needed to clarify that these Energy Code Requirements do not apply to federally regulated appliance for which the State is preempted. Most commercial refrigeration appliances used in retail food stores are already federally regulated.

Adiabatic condensers (also known as hybrid condensers) and systems using gas coolers and $CO_2$ (typically known as R744 refrigerant) can be very energy efficient when used properly. Adiabatic condensers can also significantly reduce water use in hot dry climates. $CO_2$ has far better heat transfer properties than most other common refrigerants and in many cases will allow compressors to be much smaller for a given application. $CO_2$ has the added benefits of being non-ozone depleting, non-flammable, and has a low global warming potential. Establishing efficiency standards for these technologies is necessary to prevent the Energy Code from inadvertently restricting the use of such technology in California. This will broaden the options for energy efficient equipment available to California builders.

# 120.6(e)

## Mandatory Requirements for Compressed Air Systems

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** An exception was added to Section 120.6(e) excluding healthcare facilities from the mandatory requirements for compressed air systems.

**2019 CODE:**

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

[…]

**EXCEPTION 1 to Section 120.6(e):** Alterations of existing compressed air systems that include one or more centrifugal compressors.

**EXCEPTION 2 to Section 120.6(e):** Compressed air systems, including medical gas, serving healthcare facilities.

**CHANGE SIGNIFICANCE:** The purpose of this exception is to exempt licensed healthcare facilities from compliance with this code section. This exception is necessary because licensed healthcare facilities are being brought into the scope of the Energy Code for the first time. This section has been identified as having the potential to interfere with the primary health and safety responsibilities of healthcare facilities due to stringent specifications on medical gas distribution systems. In addition, time constraints have prevented the needed analysis to determine cost effectiveness. Future code cycles may remove this exception based on more detailed analysis, partial exceptions tailored specifically for healthcare facilities, or both.

# 120.6(f)

## Mandatory Requirements for Elevators

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** An exception was added to Section 120.6(f) excluding healthcare facilities from the mandatory requirements for elevators.

**2019 CODE:**

(f) **Mandatory Requirements for Elevators.** Elevators shall meet the following requirements:

1. The light power density for the luminaires inside the elevator cab shall be no greater than 0.6 watts per square foot.

   **EXCEPTION to Section 120.6(f)1:** Interior signal lighting and interior display lighting are not included in the calculation of lighting power density.

2. Elevator cab ventilation fans for cabs without space conditioning shall not exceed 0.33 watts per CFM as measured at maximum speed.
3. When the elevator cab is stopped and unoccupied with doors closed for over 15 minutes, the cab interior lighting and ventilation fans shall be switched off until elevator cab operation resumes.
4. Lighting and ventilation shall remain operational in the event that the elevator cabin gets stuck when passengers are in the cabin.
5. Elevator Lighting and Ventilation Control Acceptance. Before an occupancy permit is granted for elevators subject to 120.6(f), the following equipment and systems shall be certified as meeting the Acceptance Requirement 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 NA7.14.

**EXCEPTION to Section 120.6(f):** Elevators located in healthcare facilities.

**CHANGE SIGNIFICANCE:** The purpose of this exception is to exempt licensed healthcare facilities from compliance with this code section. This exception is necessary because licensed healthcare facilities are being brought into the scope of the Energy Code for the first time. This section has been identified as having the potential to interfere with the primary health and safety responsibilities of healthcare facilities since occupancy sensors could fail to detect unconscious patients left alone in an elevator, potentially harming such a patient. Future code cycles may remove this exception based on more detailed analysis, partial exceptions tailored specifically for healthcare facilities, or both.

# 120.7(b)
## Wall Insulation

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** The 2019 Energy Code clarifies that all curtain walls, regardless of opacity, must meet the mandatory assembly *U*-factor requirements.

**2019 CODE:**

(b) **Wall Insulation.** The opaque portions of walls that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 7 below:

[…]

6. **Spandrel Panels and ~~Opaque~~ Curtain Wall.** The weighted average *U*-factor of the spandrel panels and ~~opaque~~ curtain wall assembly shall not exceed 0.280.

**CHANGE SIGNIFICANCE:** The purpose of this change was to remove the word "opaque" as it was unnecessary, and to be consistent with the proposed change to Reference Joint Appendix JA4. Curtain walls are defined as walls, which are distinct from fenestration. Additionally, this avoids questions related to semi-translucent materials, and at what point material is considered "opaque." The intent is to ensure that curtain walls meet these efficiency requirements, as they are applicable to curtain walls, regardless of their opacity.

Getty Images

Glass Curtain Wall System.

# 120.8

## Nonresidential Building Commissioning

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Language is added to this section to prevent duplicative commissioning requirements.

**2019 CODE:**

Nonresidential buildings other than healthcare facilities, with conditioned space of 10,000 square feet or more, shall comply with the applicable requirements of Sections 120.8(a) through 120.8(i) in the building design and construction processes. 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 those related solely to covered processes.

Nonresidential buildings other than healthcare facilities, with conditioned space of less than 10,000 square feet, shall comply with the design review requirements specified in Sections 120.8(d), and shall include any measures or requirements necessary for completing this review in the construction documents in a manner consistent with Section 120.8(e).

Healthcare facilities shall instead comply with the applicable requirements of Chapter 7 of the *California Administrative Code* (Title 24, Part 1).

[…]

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to add a provision that directs healthcare facilities to the applicable commissioning requirements of the Administrative Code, Title 24, Part 1, Chapter 7. Healthcare facilities are already subject to the commissioning requirements of the Administrative Code, making the requirements of the Energy Code potentially duplicative.

PART 4

# Nonresidential, High-Rise Residential and Hotel/Motel Occupancies— Mandatory Requirements for Lighting Systems and Equipment, and Electrical Power Distribution Systems

## Subchapter 4

Subchapter 4 identifies mandatory requirements that are applicable to all buildings regulated by the Energy Code except low-rise residential buildings. This includes high-rise residential, nonresidential, hotel/motel buildings, and covered processes. This subchapter spans from Section 130.0 through 130.5. These sections establish mandatory requirements for the design and installation of lighting and electrical power distribution systems for these buildings.

Mandatory requirements for determining when the residential lighting requirements can apply to nonresidential, high-rise residential and hotel/motel buildings are found in Section 130.0, along with how to determine luminaire power.

Sections 130.1 and 130.2 establish mandatory lighting requirements for indoor and outdoor lighting systems, including manual and automatic control requirements. Section 130.3 addresses sign lighting control requirements, and Section 130.4 identifies the acceptance and installation certificate requirements for lighting control systems. Section 130.5 is the only section in the Energy Code that addresses mandatory electrical power distribution requirements, including metering, separation of circuits, voltage drop limitations, and controlled receptacles. ■

**130.0**

**Lighting Systems and Equipment, and Electrical Power Distribution Systems – General**

**130.0(c)**

**Luminaire Classification and Power**

**130.0(c)1 – 4**

**Luminaire Classification and Power**

**130.0(c)5 – 10**
Luminaire Classification and Power

**130.1(a)**
Manual Area Controls

**130.1(b)**
Multilevel Lighting Controls

**130.1(c)1 and 2**
Shut-OFF Controls

**130.1(c)5**
Shut-OFF Controls

**130.1(d)**
Automatic Daylighting Controls

**130.1(e)**
Demand Responsive Controls

**130.1(f)**
Control Interactions

**130.2**
Outdoor Lighting Controls and Equipment

**130.2(a)**
Reserved

**130.2(b)**
Luminaire Cutoff Requirements

**130.2(c)**
Controls for Outdoor Lighting

**130.3**
Sign Lighting Controls

**130.4**
Lighting Control Acceptance
and Installation Certificate Requirements

**130.5**
Electrical Power Distribution Systems

# 130.0(c)1 – 4

## Luminaire Classification and Power

**CHANGE TYPE:**

Clarification and Modification

**CHANGE SUMMARY:**

Luminaire wattage labeling requirements were clarified, an option for determining luminaire power was added.

**2019 CODE:**

(c) **Luminaire classification and power.** Luminaires shall be classified and their wattage shall be determined as follows:

1. ~~**Luminaire labeling.**~~ Luminaire wattage shall be labeled as follows:
   A. The maximum ~~relamping~~ rated wattage or relamping rated wattage of a luminaire shall be listed on a permanent, preprinted, factory-installed label, as specified by UL 1574, 1598, 2108, or 8750, as applicable; and
   B. The factory-installed maximum ~~relamping~~ rated wattage or relamping rated 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.

      **EXCEPTION to Section 130.0(c)1B:** Peel-down labels may be used only for the following luminaires when they can accommodate a range of lamp wattages without changing the luminaire housing, ballast, transformer or wiring. Qualifying luminaires shall have a single lamp, and shall have integrated ballasts or transformers. Peel-down labels must be layered such that the rated wattage reduces as successive layers are removed.
      i. High intensity discharge luminaires, having an integral electronic ballast, with a maximum relamping rated wattage of 150 watts.
      ii. Low-voltage luminaires (except low voltage track systems), ≤ 24 volts, with a maximum relamping rated wattage of 50 watts.
      iii. Compact fluorescent luminaires, having an integral electronic ballast, with a maximum relamping rated wattage of 42 watts.
2. For luminaires with line voltage lamp holders not containing permanently installed ballasts or transformers,; the wattage of such luminaires shall be determined as follows:
   A. The maximum relamping rated wattage of the luminaire; and
   B. For recessed luminaires with line-voltage medium screw base sockets, wattage shall not be less than 50 watts per socket, or the rated wattage of the installed JA8 compliant lamps.
3. ~~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.~~

~~4. Screwbased adaptors shall not be used to convert an incandescent luminaire to any type of nonincandescent technology. Screw-based adaptors, including screw-base adaptors classified as permanent by the manufacturer, shall not be recognized for compliance with Part 6.~~

~~5. Luminaires and luminaire housings with incandescent screw base sockets shall be classified only as incandescent. Field modifications, including but not limited to hard wiring of an LED module, shall not be recognized as converting an incandescent luminaire or luminaire housing to a nonincandescent technology for compliance with Part 6 unless such sockets are removed.~~

3.~~6.~~ For ~~L~~luminaires with permanently installed or remotely installed ballasts, ~~or drivers. T~~the wattage of such luminarires ~~shall be determined as follows:~~

~~The operating input wattage of the rated ballast or lamp/ballast combination~~ shall be the operating input wattage of the rated lamp/ballast combination published in the ballast manufacturer's catalogs based on independent testing lab reports as specified by UL 1598.~~.~~

~~A. The maximum input wattage of the rated driver published in driver's manufacturer catalogs based on independent testing lab reports as specified by UL 8750 or LM-79~~.

4. For inseparable SSL luminaires and SSL luminaires with remotely mounted drivers, the maximum rated wattage shall be the maximum rated input wattage of the SSL luminaire as specified in Section 130.0(c)1 when tested in accordance with UL 1598, 2108, 8750, or IES LM-79.

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section are to redraft the language to improve clarity and streamline its application to various lighting designs and equipment. The substantive changes are necessary to ensure the Energy Code encompasses modern, modular LED systems, and to allow the use of energy efficient lamps for compliance. Specific changes for each subsection are as follows:

Section 130.0(c)1 – The purpose of the change to this section is to remove its heading. This change is necessary for consistency with the other subsections to Section 130.0(c), which do not have headings.

Section 130.0(c)2 – The purpose of the change to this section is to allow consideration of lamp wattage in recessed luminaires with line-voltage screw base sockets when the lamps populating those sockets comply with Reference Joint Appendix JA8 (JA8). This change is necessary to provide flexibility to lighting designers.

*Getty Images*

LED with Screw Base Socket vs. Incandescent – Rated wattage of LED lamp will be recognized for compliance if certified to the CEC and labeled as JA8-2016 or JA8-2019.

Sections 130.0(c)3, 4, and 5 (removed) – The purpose of removing these sections and renumbering subsequent sections is to remove language that categorizes luminaires based on the lamp socket type, rather than the lamps installed in the luminaire. Removing these sections is necessary to allow consideration of the efficiency of installed lamps.

Section 130.0(c)4 (added, renumbered) – The purpose of adding this language is to clarify that the requirement applies whether the driver is mounted within the solid-state lighting (SSL) luminaire or mounted remotely from the SSL luminaire.

# 130.0(c)5 – 10

## Luminaire Classification and Power

**CHANGE TYPE:** Clarification, Modification, and Addition

**CHANGE SUMMARY:** This section has been redrafted to improve clarity and streamline its application to various lighting designs. A provision for lighting power classification for LED tape lighting was added, and requirements for modular lighting systems were consolidated.

**2019 CODE:**

(c) **Luminaire classification and power.** Luminaires shall be classified and their wattage shall be determined as follows:

[…]

~~7~~5. For LED tape lighting and LED linear lighting with LED tape lighting components, the maximum rated wattage shall be the sum of the installed length of the tape lighting times its rated linear power density in watts per linear feet, or the maximum rated input wattage of the driver or power supply providing power to the lighting system, with tape lighting tested in accordance with UL 2108, 8750, or IES LM-79.

6. ~~Line-voltage lighting track and plug-in busway~~For modular lighting systems that allow~~s~~ 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 method-s~~as follows:

~~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:~~

A. The wattage shall be the greater of:

i. 30 watts per linear foot of track or plug-in busway; or

ii. the rated wattage of all of the luminaires included in the system, where the luminaire wattage is determined as specified in Section 130.0(c)1~~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 luminaire classification and wattage is determined according to the applicable provisions in Section 130.0(c), or 45 watts per linear foot; or~~

~~iii~~B. ~~When using a line-voltage track lighting integral current limiter,~~ For line-voltage lighting track and plug-in busway served by a track lighting integral current limiter or a dedicated track lighting supplementary overcurrent protection panel, the wattage shall be determined as follows:

i. The volt-ampere rating of the current limiter as specified by UL 1077;

ii. The sum of the ampere (A) rating of all of the current protection devices times the branch circuit voltages for track lighting supplementary overcurrent protection panel ~~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 shall 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 Biii to determine luminaire power;~~ or

~~iv. When using a dedicated track lighting supplementary overcurrent protection panel, the rated power shall be 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 Biv to determine luminaire power~~.

C. For other modular lighting systems with power supplied by a driver, power supply or transformer, including but not limited to low-voltage lighting systems, the wattage of the system shall be the maximum rated input wattage of the driver, power supply or transformer published in the manufacturer's catalogs, as specified by UL 2108 or 8750.

**EXCEPTION to Section 130.0(c)6:** For power-over-Ethernet lighting systems, power provided to installed nonlighting devices may be subtracted from the total power rating of the power-over-Ethernet system.

~~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.~~

~~B. For low-voltage lighting systems, including low voltage tracks and other low-voltage lighting systems that allow the addition of lamps, lamp holders, or luminaires without rewiring, the wattage shall be the maximum rated input wattage of the transformer, labeled in accordance with Item 1, or the maximum rated wattage published in transformer manufacturer's catalogs, as specified by UL 2108.~~

~~9. Light emitting diode (LED) Luminaires, and LED Light Engine.~~

~~A. The wattage of such luminaires 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 labeled in accordance with Section 130.0(c)1.~~

~~C. An LED lamp, integrated or nonintegrated 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 but not limited to 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 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.~~

~~E. For LED lighting systems that 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, labeled in accordance with Section 130.0(c)1 or published in the power supply manufacturer's catalog.~~

~~**EXCEPTION to Section 130.0(c)9:** Luminaires in areas that must comply with Section 150.0(k), as specified by Section 130.0(b).~~

~~10~~7. ~~The wattage of~~For all other ~~miscellaneous~~ lighting equipment not addressed by Sections 130.0(c)2 through 6, the wattage of the lighting equipment shall be the maximum rated wattage of the lighting equipment, or operating input wattage of the system, labeled in accordance with Section 130.0(c)1, or published in manufacturer's catalogs, based on independent testing lab reports as specified by UL 1574~~, or UL~~ 1598, 2108, 8750, or IES LM-79. ~~Lighting technologies listed in Subsections 2 through 9 shall be determined in accordance with the applicable requirements in Subsections 1 through 9.~~

**CHANGE SIGNIFICANCE:** Section 130.0(c)5 (new) – The purpose of adding this section is to provide language that is specific to LED tape lighting. The maximum rated wattage for LED tape lighting is the rated linear power rating of the LED tape lighting multiplied by the length of installed tape, or the maximum rated input wattage of the driver or power supply of the LED tape lighting system. A reference to the applicable UL test procedure was added and is necessary to ensure that the list of tests used in industry to rate power consumption is complete and is applicable to all types of lighting covered by this section.

Section 130.0(c)6 (previously 7) – The purpose of the change to this section is to pre-sent requirements for modular lighting in a clear, consistent, and technology neutral manner. This section now applies to modular lighting systems generally, and not solely to track-based lighting systems. Additionally, this section merges similar requirements contained in Section 130.0(c)8 for modular low-voltage systems. This change is necessary to apply consistent requirements to a diverse range of modular lighting systems, including LED systems with varied form factors and other lighting that may not make use of a traditional track or busway.

Section 130.0(c)6A – The purpose of this change is to update the lighting power allowed for modular lighting systems to correspond to similar lighting power allowances in ASHRAE 90.1-2016. Federal law (Title 42 of the United States Code, Section 6316(b092)) grants State and local governments the ability to adopt ASHRAE 90.1-2016 efficiency requirements

into the local building codes, given that the building codes do not exceed the minimum efficiency requirements of ASHRAE 90.1-2016. This change is necessary to maintain alignment with ASHRAE 90.1, consistent with the above law.

The requirement for accounting of the wattage of all luminaires in the modular lighting system was moved to this section. The change clarifies without materially altering the requirements in the Draft Express Terms and are necessary to improve the Energy Code's clarity.

Section 130.0(c)6B – The purpose of this change is to consolidate the requirements for line-voltage modular lighting systems which utilize track lighting integral current limiters or track lighting supplementary overcurrent protection panels.

Lighting power for modular systems utilizing integral current limiters is no longer dependent on the greater of the volt-ampere rating of the current limiter or 12.5 watts per linear foot of track or busway. Lighting power for these systems is now dependent solely on the volt-ampere rating of the integral current limiter. The change is necessary to improve clarity and streamline application of the two sections for the track lighting integral current limiter and overcurrent protection panel into one section.

Section 130.0(c)6C – The purpose this change is to relocate requirements for low-voltage modular lighting systems from Section 130.0(c)8B to this section. This section now refers to modular lighting systems with a driver, power supply, or transformer. Modular lighting systems can use any of these technologies for providing input power. The change clarifies without materially altering the requirements.

Exception to Section 130.0(c)6 – The purpose of adding this exception for Power over Ethernet (PoE) lighting systems (a type of modular lighting system) is to exclude the wattage of any nonlighting devices from lighting power calculations. Section 130.0(c)6 is intended to quantify lighting power for modular lighting systems only. Inclusion of nonlighting devices in lighting power calculations would make it difficult to achieve compliance using these systems.

Section 130.0(c)7 (previously 10) – This change relocates the requirements for determining wattage of all other lighting equipment types from Section 130.0(c)10 to this section. The language was also updated to reduce redundant phrasing and to improve clarity.

Reference to standard UL 8750 was added to cover lighting types that may be subject to this section. The addition of the UL test procedure is necessary to ensure that the list of tests used in industry to rate power consumption is complete and is applicable to all types of lighting that may be found in a nonresidential setting. The improvements to phrasing are necessary to improve the Energy Code's clarity and consistency.

Section 130.0(c)8 (removed) – This section was removed. Requirements for low-voltage lighting systems have been relocated to other sections of the Energy Code. Low-voltage nonmodular lighting systems are addressed in Section 130.0(c)2. Low voltage modular lighting systems are addressed in Section 130.0(c)6.

Section 130.0(c)9 (removed) – This section was removed to simplify requirements for LED lighting. The requirements for Solid State Lighting

(SSL) are reorganized and redrafted into other sections of the Energy Code. LED light sources are addressed in Section 130.0(c)2 which covers light fixtures populated with LED lamps, Sections 130.0(c)4 and 130.0(c)5, which cover integrated SSL fixtures and tape lighting respectively, and Section 130.0(c)6, which covers modular LED systems. This change is necessary to remove redundant language and to prevent conflict between this section and adopted new sections related to LED light sources.

Mario Marco/Moment/Getty Images

LED Tape Lighting – New for 2019 Energy Code, the maximum rated wattage for LED tape lighting can be determined according to the rated linear power rating of the LED tape lighting multiplied by the length of installed tape, or the maximum rated input wattage of the driver or power supply of the LED tape lighting system.

# 130.1(a)
## Manual Area Controls

**CHANGE TYPE:** Clarification and Addition

**CHANGE SUMMARY:** Manual area control language was simplified, and new language was added to address manual area controls in healthcare facilities.

**2019 CODE:**

(a) **Manual Area Controls.**

~~1. All luminaires shall be functionally controlled with manual ON and OFF lighting controls.~~ Each area enclosed by ceiling-height partitions shall ~~be independently controlled~~provide lighting controls that allow the lighting in that area to be manually turned on and off. The manual control shall~~.~~:

1. Be readily accessible; and

   **EXCEPTION to Section 130.1(a)1:** Public restrooms having two or more stalls, parking areas, stairwells, and corridors may use a manual control not accessible to unauthorized personnel.

2. Be located in the same enclosed area with the lighting it controls; and

   **EXCEPTION 1 to Section 130.1(a)2:** For malls and atria, auditorium areas, retail merchandise sales areas, wholesale showroom areas, commercial and industrial storage areas, general commercial and industrial work areas, convention centers, arenas, psychiatric and secure areas in healthcare facilities, and other areas where placement of a manual area control poses a health and safety hazard, the manual area control may instead be located so that a person using the control can see the lights or area controlled by that control, or visually signal or display the current state of the controlled lighting.

   **EXCEPTION 2 to Section 130.1(a)2:** In healthcare facilities, for restrooms and bathing rooms intended for a single occupant, the lighting control may be located outside the enclosed area but directly adjacent to the door.

3. Provide separate control of general, floor display, wall display, window display, case display, ornamental, and special effects lighting, such that each type of lighting can be turned on or off without turning on or off other types of lighting, and without turning on or off any other equipment.

**EXCEPTION to Section 130.1(a)~~1~~:** Up to 0.2 watts per square foot of indoor lighting ~~in any area within a building~~ may be continuously illuminated to allow for means of egress illumination consistent with *California Building Code* Section 1008.~~,~~ Egress lighting complying with this wattage limitation is not required to comply with manual area control requirements if:

~~A~~1. The area is designated for means of egress on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1; and

~~B~~2. The controls for the egress lighting are not accessible to unauthorized personnel.

2. The lighting controls shall meet the following requirements:

   A. Be readily accessible; and

   B. Be operated with a manual control that is located in the same room or area with the lighting that is controlled by that lighting control.

   **EXCEPTION 1 to Section 130.1(a)2:** In malls and atria, auditorium areas, retail merchandise sales areas, wholesale showroom areas, commercial and industrial storage areas, general commercial and industrial work areas, convention centers, and arenas, the lighting control shall

1. be located so that a person using the lighting control can see the lights or area controlled by that lighting control, or

2. so that the area being lit is annunciated.

**EXCEPTION 2 to Section 130.1(a)2:** Public restrooms having two or more stalls, parking areas, stairwells, and corridors may use a manual control not accessible to unauthorized personnel.

3. **Other Lighting Controls.**

   A. 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.

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section are to improve the readability and enhance clarity, to add healthcare facilities to an existing exception relating to the location of controls, and to add a separate exception related to restrooms and bathrooms in healthcare facilities.

The changes to the exceptions are necessary to incorporate healthcare facilities into the Energy Code and ensure controls are not required in inappropriate locations. The remaining changes to the section are not substantive.

Section 130.1(a)2, Exception 1 – The purpose of this change is to exempt psychiatric and secure areas in healthcare facilities from control location requirements. This exception is necessary because licensed healthcare facilities are included in the scope of the Energy Code for the first time, and area lighting controls (manual light switches) must be located where only authorized users have access to them in these types of healthcare settings. In addition, the phrase "and other areas where placement of a manual area control poses a health and safety hazard" is added to ensure that the application of the exception is not based on an exact

match of the terms used in the exception with those stated on blueprints or other plans.

Section 130.1(a)2, Exception 2 – The purpose of adding this exception is to exempt single occupant restrooms, and bathing rooms in healthcare facilities from control location requirements. This exception is necessary because patient rooms in healthcare facilities are commonly designed with restrooms that double as bathing areas, and the area lighting controls (light switch) must be allowed to be placed in a safe, dry area, but still within reach of the user or caregiver.

Manual Area Control Options – Depending on the space size, connected lighting load, and space type, Section 130.1(b) of the Energy Code details when the area control for a space must be a dimmer.
Source: California Energy Commission

# 130.1(b)

## Multilevel Lighting Controls

**CHANGE TYPE:** Clarification and Addition

**CHANGE SUMMARY:** Multilevel lighting control requirements were simplified, and exceptions were added to address restrooms and healthcare facilities.

**2019 CODE:**

(b) **Multilevel 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 provide multilevel lighting controls that ~~meets the following requirements~~allow the level of lighting to be adjusted up and down. The multilevel controls shall~~:~~

~~1. Lighting shall have~~provide the ~~required~~ number of control steps and meet the uniformity requirements specified in ~~accordance with~~ TABLE 130.1-A.;

~~2. Multi-level lighting controls shall not override the functionally of other lighting controls required for compliance with Sections 130.1(a), and (c) through (e); and~~

~~3. Dimmable luminaires shall be controlled by a dimmer control that is capable of controlling lighting through all required lighting control steps and that allows the manual ON and OFF functionality required by Section 130.1(a).~~

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

**EXCEPTION ~~2~~ 1 to Section 130.1(b):** An area enclosed by ceiling height partitions that has only one luminaire with no more than two lamps.

**EXCEPTION 2 to Section 130.1(b):** Restrooms.

**EXCEPTION 3 to Section 130.1(b):** Healthcare facilities.

~~The areas specified in Sections 130.1(c)6 and 7 are not also required to meet the requirements of Section 130.1(b).~~

[…]

**TABLE 130.1-A Multilevel Lighting Controls and Uniformity Requirements**

| Luminaire Type | Minimum Required Control Steps (percent of full rated power[1]) | Uniform level of illumination shall be achieved by: |
|---|---|---|
| Line-voltage sockets except GU-24<br>Low-voltage incandescent systems<br>LED luminaires and LED source systems<br>GU-24 rated for LED | Continuous dimming 10-100 percent | |
| GU-24 sockets rated for fluorescent > 20 watts<br>Pin-based compact fluorescent > 20 watts[2] | Continuous dimming 20-100 percent | |
| GU-24 sockets rated for fluorescent ≤ 20 watts<br>Pin-based compact fluorescent ≤ 20 watts[2]<br>Linear fluorescent and U-bent fluorescent ≤ 13 watts | Minimum one step between 30-70 percent | Stepped dimming; or<br>Continuous dimming; or<br>Switching alternate lamps in a luminaire |
| Linear fluorescent and U-bent fluorescent > 13 watts | Minimum one step in each range:<br>20-40 % 50-70 % 75-85 % 100 % | Stepped dimming; or<br>Continuous dimming; or<br>Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire illuminating the same area and in the same manner |
| Track Lighting | Minimum one step between 30 – 70 percent | Step dimming; or<br>Continuous dimming; or<br>Separately switching circuits in multicircuit track with a minimum of two circuits. |
| HID > 20 watts<br>Induction > 25 watts<br>Other light sources | Minimum one step between 50 - 70 percent | Stepped dimming; or<br>Continuous dimming; or<br>Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner. |

1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor
2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps

**EXCEPTION 1 to Table 130.1-A, Minimum Required Control Steps:** Classrooms with a connected general lighting load of 0.7 watts per square feet or less shall have a minimum of one control step between 30-70 percent of full rated power, regardless of luminaire type.

**EXCEPTION 2 to Table 130.1-A, Minimum Required Control Steps:** Library stack aisles, aisle ways and open areas in warehouses, parking garages, parking areas, loading and unloading areas, stairwells, and corridors shall have a minimum of one control step between 20–60 percent of full rated power, regardless of luminaire type.

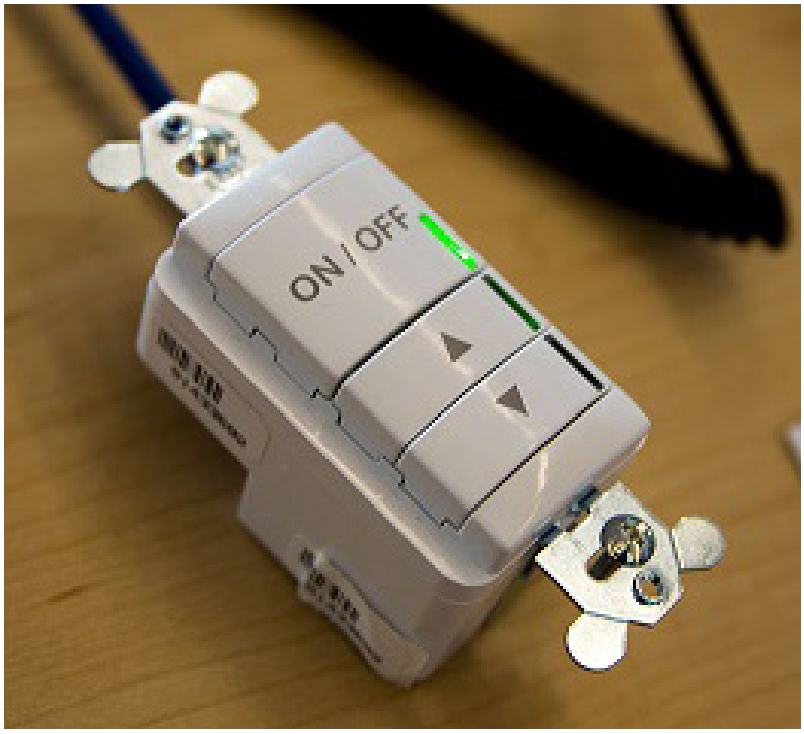
**CHANGE SIGNIFICANCE:** The purpose of the changes to this section are to improve the readability and enhance the clarity of the Energy Code.

The provisions for the interactions of multilevel controls with other controls have been relocated to Section 130.1(f).

Two exceptions have been relocated to the footnote of Table 130.1-A, the exception for classrooms, and the exception for areas specified in Sections 130.1(c)6 and 7. Two new exceptions have been added, one for restrooms, and one for healthcare facilities. The new exceptions are described below.

Exception 2 to Section 130.1(b) – The purpose of adding this exception is to facilitate new occupant sensing requirements for restroom lighting. Advancements in occupant sensing technology have overcome prior concerns about detection of occupants in stalls, therefore occupant sensing controls are now required. Occupancy sensing controls have a greater potential for energy savings than dimming of restroom lighting (which rarely, if ever, occurs). This change is necessary to support a more energy efficient and cost effective control strategy in restrooms.

Exception 3 to Section 130.1(b) – The purpose of this exception is to exempt licensed healthcare facilities from compliance with this code section. This exception is necessary because licensed healthcare facilities are being brought into the scope of the Energy Code for the first time, but this section has been identified as duplicating, and potentially conflicting, with existing requirements for healthcare facilities contained in *California Electrical Code* Article 517.




Manual Dimmer – Section 130.1(b) of the Energy Code describes when manual multilevel controls like dimmers are required for nonresidential spaces.
Source: California Energy Commission

# 130.1(c)1 and 2

## Shut-OFF Controls

**CHANGE TYPE:** Clarification and Addition

**CHANGE SUMMARY:** Automatic shut-off control requirements were clarified, and exceptions were removed, and new exceptions were added.

**2019 CODE:**

(c) **Shut-OFF Controls.** All installed indoor lighting shall be equipped with controls able to automatically reduce lighting power when the space is typically unoccupied.

**EXCEPTION to Section 130.1(c):** Healthcare facilities.

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, or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and
   B. Separate controls for the lighting on each floor, other than lighting in stairwells; and
   C. Separate controls for a space enclosed by ceiling height partitions not exceeding 5,000 square feet; and

      **EXCEPTION to Section 130.1(c)1C:** In the following function areas the area controlled may not exceed 20,000 square feet: malls, auditoriums, single tenant retail, industrial, convention centers, and arenas.
   D. Separate controls for general, display, ornamental, and display case lighting; and
   E. For automatic time-switch controls, may include a manual-on mode.

**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:** Up to 0.1 watts per square foot of lighting in any area within a building may be continuously illuminated, provided that the area is designated for means of egress on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1.

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

**EXCEPTION 5 to Section 130.1(c)1:** Illumination provided by lighting equipment that is designated for emergency lighting, connected to an emergency power source or battery supply, and is intended to function in emergency mode only when normal power is absent.

2. Countdown timer switches ~~shall not~~may be used to comply with the automatic shut-OFF control requirements in Section 130.1(c)1 only in closets less than 70 square feet, and server aisles in server rooms. The maximum timer setting shall be 10 minutes for closets, and 30 minutes for server aisles.

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

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

   […]

   **EXCEPTION 2 to Section 130.1(c):** Lighting providing means of egress illumination, as the term is used in the *California Building Code*, shall be configured to provide no less than the amount of light required by *California Building Code* Section 1008 while in the partial-off mode.

**CHANGE SIGNIFICANCE:** Section 130.1(c) – The change to this section adds an explanatory sentence to its header for consistency with the other subsections of Section 130.1.

Exception to Section 130.1(c) – The purpose of this exception is to exempt licensed healthcare facilities from the shut-off control requirements. This exception is necessary because licensed healthcare facilities are included in the scope of the Energy Code for the first time, and this section is identified as having the potential to interfere with the primary health and safety responsibilities of healthcare facilities.

Section 130.1(c)1 – The purpose of the change is to expressly permit automatic time-switch controls to operate in manual-on mode. This change is necessary to clarify that manual-on can be utilized for the operation of the building space. Manual-on behavior can produce energy savings since lighting will not turn on until the control is activated manually by building occupants. This will reduce the amount of time that indoor lighting is on when the space is unoccupied.

Section 130.1(c)2 – The change to this section incorporates the two exceptions directly into the section language. Exceptions 1 and 2 to Section 130.1(c)2 were removed to accommodate this change. This change clarifies without materially altering the requirements.

Exception 2 to Section 130.1(c) – The purpose of the addition of this exception is to align the shut-off control requirements of Section 130.1(c) with the minimum egress illumination requirements of the *California Building Code*.

# 130.1(c)5
## Shut-OFF Controls

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Restrooms are now required to have occupant sensing controls.

**2019 CODE:**

(c) **Shut-OFF Controls.** All installed indoor lighting shall be equipped with controls able to automatically reduce lighting power when the space is typically unoccupied.

[…]

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, and restrooms 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 areas required by Section 130.1(b) to have multilevel lighting controls, the occupant sensing controls shall function either as a:

A. Partial-ON Occupant Sensor capable of automatically activating between 50–70 percent of controlled lighting power, or

B. Vacancy Sensor, where all lighting responds to a manual ON input only.

In areas not required by Section 130.1(b) to have multilevel lighting controls, the occupant sensing controls shall function either as a:

A. Occupant Sensor; or

B. Partial-ON Occupant Sensor, or

C. Vacancy Sensor, where all lighting responds to a manual ON input only.

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.

**CHANGE SIGNIFICANCE:** The change to this section adds restrooms to the areas required to have occupancy sensing controls. This change is responsive to advances in occupant sensing control technology that accurately determines occupancy even with the presence of restroom stalls and is consistent with a finding that automatic shut-off controls in restrooms has a greater potential for energy savings than dimming controls. This change also aligns with requirements in ASHRAE 90.1-2016.

# 130.1(d)

## Automatic Daylighting Controls

**CHANGE TYPE:** Clarification and Addition

**CHANGE SUMMARY:** Automatic daylighting control requirements were restructured for clarity, and new exceptions were added.

**2019 CODE:**

(d) **Automatic Daylighting Controls.** The general lighting in skylit daylit zones and primary sidelit daylit zones, as well as the general lighting in the combined primary and secondary sidelit daylit zones in parking garages, shall provide controls that automatically adjust the power of the installed lighting up and down to keep the total light level stable as the amount of incoming daylight changes. For skylight located in an atrium, the skylit daylit zone definition shall apply to the floor area directly under the atrium and the top floor area directly adjacent to the atrium.

~~1. Daylit Zones shall be defined as follows:~~

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

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

~~B. **PRIMARY SIDELIT DAYLIT ZONE** is the area in plan view and is 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 in plan view and is 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~~1. All ~~S~~skylit ~~D~~daylit ~~Z~~zones and ~~P~~primary ~~S~~sidelit ~~D~~daylit ~~Z~~zones, and the combined primary and secondary sidelit daylit zones in parking garages shall be shown on the plans.

**NOTE:** Parking areas on the roof of a parking structure are outdoor hardscape, not skylit daylit areas.

~~B~~2. ~~Luminaires in the Skylit Daylit Zone shall be controlled separately from those in the Primary Sidelit Daylit Zones.~~The automatic daylighting controls shall provide separate control for luminaires in each type of daylit zone. ~~C.~~ Luminaires that fall in both a ~~S~~skylit and P~~rimary~~ ~~S~~sidelit ~~D~~daylit ~~Z~~zone shall be controlled as part of the ~~S~~skylit ~~Daylit~~ ~~Z~~zone.

~~D~~3. ~~**Automatic Daylighting Control Installation and Operation.** For luminaires in daylight zones,~~ The 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. The location where calibration adjustments are made to automatic daylighting controls shall be readily accessible to authorized personnel and may be inside a locked case or under a cover which requires a tool for access~~.

~~ii~~A. For spaces required to install multilevel controls under Section 130.1(b), adjust lighting via continuous dimming or ~~Automatic daylighting controls shall provide functional multilevel lighting having at least~~ the number of control steps ~~specified in TABLE 130.1-A~~provided by the multilevel controls;~~.~~

~~EXCEPTION 1 to Section 130.1(d)2Dii: Controlled lighting having a lighting power density less than 0.3 W/ft2 is not required to provide multilevel lighting controls.~~

~~iii~~B. For each space, ensure the combined illuminance from the controlled lighting and daylight ~~shall~~ is not ~~be~~ less than the illuminance from controlled lighting when no daylight is available;~~.~~

~~iv~~C. ~~In areas served by lighting that is daylight controlled~~For areas other than parking garages, ensure that, when the daylight illuminance is greater than 150 percent of the design illuminance received from the general lighting system at full power, the general lighting power in that daylight zone shall be reduced by a minimum of 65 percent;~~.~~ and

D. For parking garages, ensure that when illuminance levels measured at the farthest edge of the secondary sidelit zone away from the glazing or opening are greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power consumption is zero.

4. When photosensors are located within the daylit zone, at least one photosensor shall be located so that they are not readily accessible to unauthorized personnel.
5. The location where calibration adjustments are made to the automatic daylighting controls shall be readily accessible to authorized personnel but may be inside a locked case or under a cover which requires a tool for access.

**EXCEPTION 1 to Section 130.1(d):** Areas under skylights where it is documented that existing adjacent structures or natural objects block direct sunlight for more than 1,500 daytime hours per year between 8 a.m. and 4 p.m.

**EXCEPTION 2 to Section 130.1(d):** Areas adjacent to vertical glazing below an overhang, where the overhang covers the entire width of the vertical glazing, no vertical glazing is above the overhang, and the ratio of the overhang projection to the overhang rise is greater than 1.5 for South, East and West orientations or greater than 1 for North orientations.

**EXCEPTION 3 to Section 130.1(d):** 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, or parking garage areas where the total combined general lighting power in the sidelit daylight zones is less than 60 watts.

**EXCEPTION 4 to Section 130.1(d):** Rooms that have a total glazing area of less than 24 square feet, or parking garage areas with a combined total of less than 36 square feet of glazing or opening.

**EXCEPTION 5 to Section 130.1(d):** For parking garages, luminaires located in the daylight adaptation zone and luminaires for only dedicated ramps. Daylight adaptation zone and dedicated ramps are defined in Section 100.1.

**EXCEPTION 6 to Section 130.1(d):** Luminaires in sidelit daylit zones in retail merchandise sales and wholesale showroom areas.

~~**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 that have a total glazing area of less than 24 square feet.~~

~~**EXCEPTION 3 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 a 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 from other lighting in the parking garage 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. The location where calibration adjustments are made to the automatic daylighting controls shall be readily accessible to authorized personnel but may be inside a locked case or under a cover which requires a tool for access.~~

~~ii. Automatic daylighting controls shall be multilevel, continuous dimming or ON/OFF.~~

~~iii. 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. When illuminance levels measured at the farthest edge of the secondary sidelit zone away from the glazing of opening are 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.~~

**CHANGE SIGNIFICANCE:** Section 130.1(d) – The purpose of the changes to this section are to improve the readability and enhance clarity, to amend the requirement for all photosensors to be located so that they are not readily accessible, and to add exceptions to address circumstances where daylighting may not be effective.

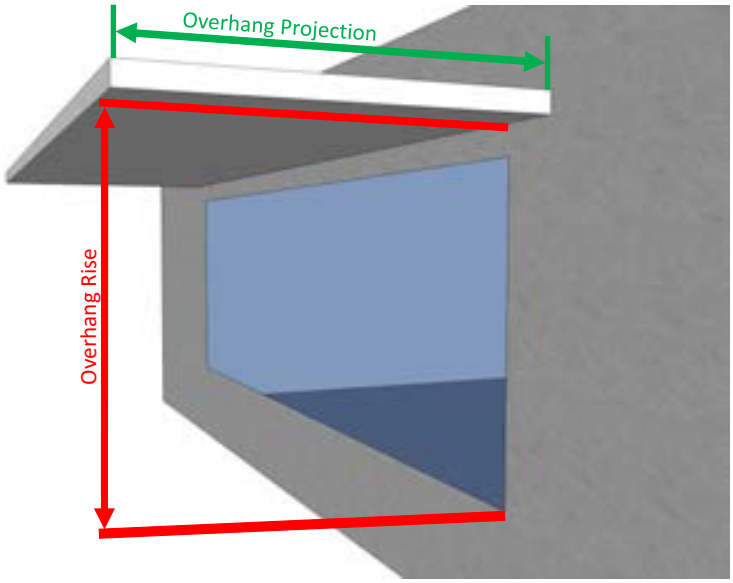
The definitions for "Skylit Daylit Zone," "Primary Sidelit Daylit Zone," and "Secondary Sidelit Daylit Zone," were relocated to Section 100.1.

Section 130.1(d)4 – This change specifies that at least one photosensor shall be located so that they are not readily accessible to unauthorized personnel, rather than all photosensors. This change is necessary to prevent inadvertently restricting or prohibiting lighting products that include an integrated photosensor.

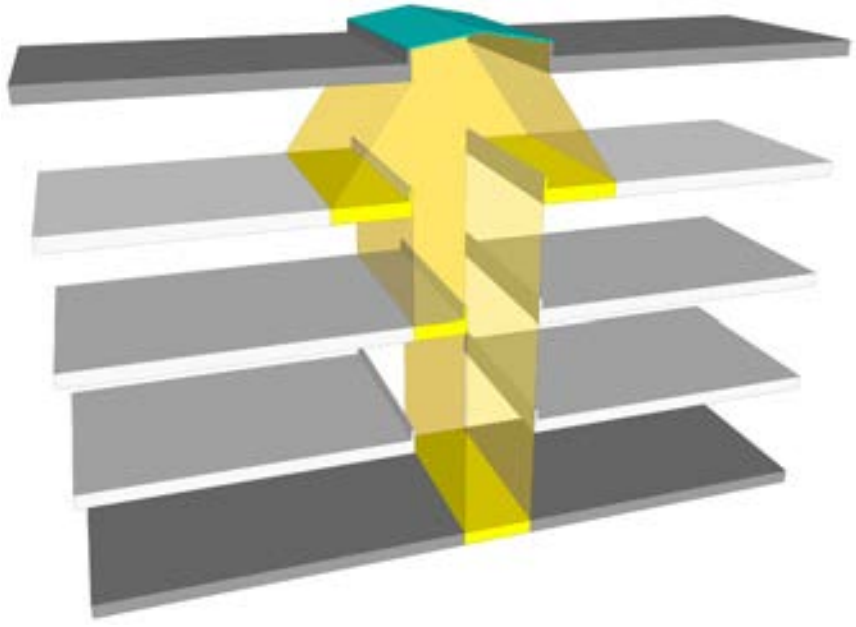
Exceptions 1 and 2 to Section 130.1(d) – The purpose of adding these two exceptions is to address scenarios with limited access to direct sunlight. In buildings with large overhangs or nearby obstructions which block direct access to sunlight, the daylit zone will receive a significantly reduced amount of daylighting. Adding Exceptions 1 and 2 is necessary to prevent daylighting controls from being installed where it may not be utilized effectively.

Exception 6 to Section 130.1(d) – The purpose of adding this exception is to address the need for uniform lighting in merchandise sales and

wholesale showroom areas. This exception is necessary to address concerns regarding lighting gradients where merchandise is displayed in a sidelit daylit area.




Overhangs – Overhangs can limit the amount of daylight that enters a space. For South, East, and West-facing fenestration, if the overhang projection-to-rise ratio is 1.5 or greater, the area adjacent to that fenestration is exempt from the daylighting control requirements. For north-facing fenestration, these areas are exempt if the overhang projection-to-rise ratio is 1.0 or greater. This is detailed in Exception 2 to Section 130.1(d) of the Energy Code.
Source: California Energy Commission



Atriums – New language was added to clarify which areas are considered daylit zones and are subject to daylighting control requirements.
Source: Kevin Mouayang, California Energy Commission

# 130.1(e)

## Demand Responsive Controls

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Demand responsive control requirements were relocated to Section 110.12.

**2019 CODE:**

(e) **Demand Responsive Controls.** See Section 110.12 for requirements for demand responsive lighting controls.

~~1. foot or less, shall be capable of automatically reducing lighting power in response to a Demand Response Signal; so that the total lighting power of non-excluded spaces can be lowered by a minimum of 15 percent below the total installed lighting power when a Demand Response Signal is received. Lighting shall be reduced in a manner consistent with uniform level of illumination requirements in TABLE 130.1-A.~~

~~**EXCEPTION to Section 130.1(e):** Lighting not permitted by a health or life safety statute, ordinance, or regulation to be reduced shall not be counted toward the total lighting power.~~

~~2. Demand responsive controls and equipment shall be capable of receiving and automatically responding to at least one standards-based messaging protocol by enabling demand response after receiving a demand response signal.~~

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to consolidate all demand response requirements into a single section. The demand response requirements have been relocated to Section 110.12.

# 130.1(f)
## Control Interactions

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** This new section was added to specify requirements for lighting control interactions.

**2019 CODE:**

(f) **Control Interactions.** Each lighting control installed to comply with Section 130.1 shall permit or incorporate the functions of the other lighting controls required by this section.

1. For general lighting, the manual area control shall permit the level or amount of light provided while the lighting is on to be set or adjusted by the controls specified in Section 130.1(b), (c), (d), and (e).
2. The manual area control shall permit the shutoff control to turn the lighting down or off.
3. The multilevel lighting control shall permit the automatic daylighting control to adjust the electric lighting level in response to changes in the amount of daylight in the daylit zone.
4. The multilevel lighting control shall permit the demand responsive control to adjust the lighting during a demand response event and to return it to the level set by the multilevel control after the event.
5. The shutoff control shall permit the manual area control to turn the lighting on. If the on request occurs while an automatic time switch control would turn the lighting off, then the on request shall be treated as an override request consistent with Section 130.1(c)3.
6. The automatic daylighting control shall permit the multilevel lighting control to adjust the level of lighting.
7. For lighting controlled by multilevel lighting controls and by occupant sensing controls that provide an automatic-on function, the controls shall provide a partial-on function that is capable of automatically activating between 50–70 percent of controlled lighting power.

**CHANGE SIGNIFICANCE:** The purpose of adding this section is to clarify the expected interactions between the lighting controls required by Section 130.1. This section provides specific requirements for the interactions of the mandatory lighting control requirements. This is necessary to ensure that all of the lighting controls are installed and operating in accordance with the requirements of the Energy Code, to prevent control operation from becoming antagonistic, to prevent confusion on the part of the lighting system designer or installer, and to ensure complete control of the lighting system is available to building operators.

# 130.2(a)
## Reserved

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Motion sensor requirements specific to outdoor incandescent lighting were no longer relevant, and thus were removed.

**2019 CODE:**

(a) **RESERVED~~Outdoor Incandescent Lighting.~~** ~~All outdoor incandescent luminaires rated over 100 watts, determined in accordance with Section 130.0(c)2, shall be controlled by a motion sensor.~~

**CHANGE SIGNIFICANCE:** The purpose of this change is to remove the motion sensor requirement applicable to outdoor incandescent lighting. This requirement is redundant with the motion sensor requirements applicable to all lighting in Section 130.2(c).

# 130.2(b)

## Luminaire Cutoff Requirements

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** Redundant language that is included in the Green Code was removed, and the trigger for outdoor luminaire cutoff requirements was modified.

**2019 CODE:**

(b) **Luminaire Cutoff Requirements.** All outdoor luminaires of 6,200 initial luminaire lumens or greaterrated 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:

1. Maximum zonal lumens for Backlight, Uplight, and Glare shall be in accordance with Title 24, Part 11, Section 5.106.8There are no Backlight requirements in Section 130.2 of Part 6; and
2. Maximum zonal lumens for Uplight shall be in accordance with TABLE 130.2-A; and
3. Maximum zonal lumens for Glare shall be in accordance with TABLE 130.2-B.

**NOTE:** Title 24, Part 11, Section 5.106.8 includes additional restrictions on backlight, uplight and glare that may apply.

**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 not permitted by a health or life safety statute, ordinance, or regulation to be a cutoff luminaire.

**EXCEPTION 4 to Section 130.2(b):** Temporary outdoor lighting.

**EXCEPTION 5 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 BUG requirements in Section 130.2(b); and
B. Spacing between existing poles is greater than six 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.

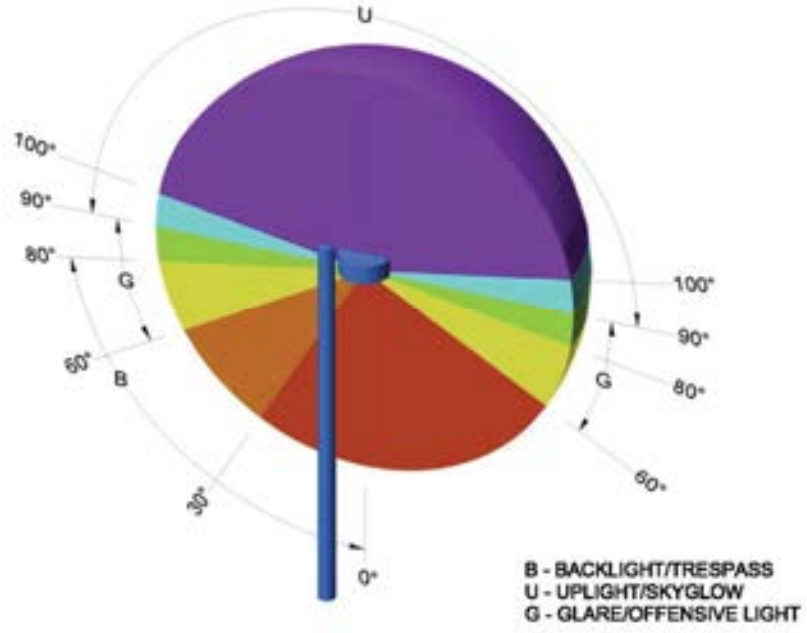
**EXCEPTION 6 to Section 130.2(b):** Luminaires that illuminate the public right of way on publicly maintained roadways, sidewalks, and bikeways.

**EXCEPTION 7 to Section 130.2(b):** Outdoor lighting attached to a high-rise residential or hotel/motel building and separately controlled from the inside of a dwelling unit or guest room.

**CHANGE SIGNIFICANCE:** Section 130.2(b), Tables 130.2-A and -B – The purpose of the change to this section and its associated tables is to remove language that is redundant with the requirements contained in the referenced section of the *California Green Building Standards Code* (CALGreen). The CALGreen Code contains the maximum allowable backlight, uplight, and glare requirements that were previously included in this section.

The trigger for outdoor luminaire cutoff requirements was changed from a wattage threshold to an initial lumens threshold. Outdoor luminaires rated at 6,200 initial lumens or greater must now meet cutoff requirements. This change is necessary to account for LED technology and ensure technology neutrality in this section's application.

Exception 7 to Section 130.2(b) – The purpose of adding this exception is to clarify that outdoor lighting attached to a high-rise residential or hotel/motel building falls under the low-rise residential lighting requirements as specified in Section 130.0(b). This exception restates existing language in Section 130.0(b)2, and is added to clarify how the requirements apply, and to prevent nonresidential controls from being installed in low-rise residential lighting applications.




Backlight, Uplight, and Glare Ranges
Source: California Energy Commission, 2019 Nonresidential Compliance Manual

# 130.2(c)

## Controls for Outdoor Lighting

**CHANGE TYPE:** Clarification, Addition, and Modification

**CHANGE SUMMARY:** Language for outdoor lighting controls was modified and rewritten for clarity, and exceptions were modified and added to account for LED lighting.

**2019 CODE:**

(c) **Controls for Outdoor Lighting.** Outdoor lighting ~~controls~~ shall be independently controlled from other electrical loads, and the controls for outdoor lighting shall ~~installed that~~ meet the following functional requirements: ~~as applicable:~~

**EXCEPTION 1 to Section 130.2(c):** Outdoor lighting not permitted by a health or life safety statute, ordinance, or regulation to be turned OFF or reduced.

**EXCEPTION 2 to Section 130.2(c):** Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

1. **Daylight Availability.** All installed outdoor lighting shall be controlled by a photo control, ~~or outdoor~~astronomical time-switch control, or other control capable of automatically shutting OFF the outdoor lighting when daylight is available.

2. **Automatic Scheduling Controls.**

   A. Automatic scheduling controls shall be capable of reducing the outdoor lighting power by at least 50 percent and no more than 90 percent, and separately capable of turning the lighting OFF, during scheduled unoccupied periods.

   B. Automatic scheduling controls shall allow scheduling of a minimum of two nighttime periods with independent lighting levels, and may include an override function that turns lighting ON during its scheduled dim or OFF state for no more than two hours when an override is initiated.

   C. Acceptance tests of outdoor lighting controls shall verify the scheduled occupied and unoccupied periods, as specified in Section 130.4(a)6.

   D. Automatic scheduling controls shall be installed for all outdoor lighting, and may be installed in combination with motion sensing controls or other outdoor lighting controls.

3. **Motion Sensing Controls.**

   A. Motion sensing controls shall be capable of reducing the outdoor lighting power of each controlled luminaire by at least 50 percent and no more than 90 percent, and separately capable of turning the luminaire OFF, during unoccupied periods.

   B. Motion sensing controls shall be capable of reducing the lighting to its dim or OFF state no longer than 15 minutes after the area has been vacated, and of returning the lighting to its ON state when the area becomes occupied.

C. No more than 1,500 watts of lighting power shall be controlled by a single sensor.

D. Motion sensing controls shall be installed for the following luminaires, and may be installed for other outdoor lighting and in combination with other outdoor lighting controls:

i. Outdoor luminaires other than Building Façade, Ornamental Hardscape, Outdoor Dining, or Outdoor Sales Frontage lighting, where the bottom of luminaire is mounted 24 feet or less above grade; and,

ii. Outdoor wall mounted luminaires installed for Building Façade, Ornamental Hardscape or Outdoor Dining lighting that have a bilaterally symmetric distribution as described in the IES Handbook (typically referred to as "wall packs") mounted 24 feet above grade or lower.

~~All installed outdoor lighting shall be independently controlled from other electrical loads by an automatic scheduling control.~~

~~3. All installed outdoor lighting, where the bottom of the luminaire is mounted 24 feet or less above the ground, shall be controlled with automatic lighting controls that meet all of the following requirements:~~

~~A. Shall be motion sensors or other lighting control systems that automatically controls lighting in accordance with Item B in response to the area being vacated of occupants; and~~

~~B. Shall be capable of automatically reducing the lighting power of each luminaire by at least 40 percent but not exceeding 90 percent, or provide continuous dimming through a range that includes 40 percent through 90 percent, and~~

~~C. Shall employ auto-ON functionality when the area becomes occupied; and~~

~~D. 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 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~~ 1 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 l~~Luminaires with a maximum rated wattage of 30 40 watts each are not required to have motion sensing controls~~; or~~

~~C. Linear lighting with a maximum wattage of 4 watts per linear foot of luminaire~~.

**EXCEPTION 4 2 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~~are not required to have motion sensing controls.

**EXCEPTION 3 to Section 130.2(c)3:** Lighting subject to a health or life safety statute, ordinance, or regulation may have a minimum time-out period longer than 15 minutes or a minimum dimming level above 50 percent when necessary to comply with the applicable law.

~~4. For Outdoor Sales Frontage 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 90 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 90 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.~~

~~D. Outdoor wall mounted luminaires having a bilaterally symmetric distribution as described in the IES Handbook (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.~~

**CHANGE SIGNIFICANCE:** Section 130.2(c) – The purpose of the changes to this section, its subsections, and exceptions, is to improve readability by reorganizing the requirements in an itemized format so that Section 130.2(c)1 is about daylight availability, Section 130.2(c)2 is about automatic time-switch controls, and Section 130.2(c)3 is about motion sensing controls. Subsections specific to outdoor sales frontage, building façade, ornamental hardscape, and outdoor dining lighting applications were removed. These lighting applications are now subject to the general control requirements applicable to all outdoor lighting applications.

Section 130.2(c)2 – The purpose of the change to this section is to clarify and simplify the section's layout and phrasing. The term "automatic scheduling control" is used in place of the prior term "part-night control," and its required behavior is specified in the section rather than in a separate definition. The language has been updated to clearly state that the ability to reduce the lighting power and the ability to turn lighting off are separate and distinct requirements.

Section 130.2(c)3 – The purpose of the change to this section is to clarify and simplify the section's layout and phrasing, to provide language

that states that the controls may be installed in combination with other lighting controls.

Exception 1 to Section 130.2(c)3 – The purpose of the change to this exception is to reduce wattage thresholds for the motion sensor requirements for outdoor lighting. This change was made to account for low-wattage LED lighting, and applies to all outdoor luminaires that are rated at 40 watts or less, rather than specifying separate wattage thresholds for different types of outdoor luminaires, thus simplifying the requirements.

Exception 2 to Section 130.2(c)3 – The purpose of the change to this exception is to more clearly state its purpose and application, using language consistent with the language added to Exception 1. The change clarifies without materially altering the requirements.

Exception 3 to Section 130.2(c)3 – The purpose of the change to this exception is to add an exception consistent with Exception 3 to Section 130.2(b), and with similar exceptions for demand responsive controls. Adding the exception is necessary to ensure consistency in addressing circumstances where health or life safety statutes, ordinances, or regulations apply to outdoor lighting.

*Getty Images*

Outdoor Pole Lighting – Pole lighting is subject to automatic shutoff control and reduction of power requirements, depending on the application, per Section 130.2(c) of the Energy Code.

# 130.3
## Sign Lighting Controls

**CHANGE TYPE:** Clarification, Addition, and Modification

**CHANGE SUMMARY:** Language was added to exclude exit signs and healthcare facilities from the sign lighting control requirements.

**2019 CODE:**

Nonresidential buildings other than healthcare facilities, high-rise residential buildings, and hotel/motel buildings shall comply with the applicable requirements of Sections 130.3(a)1 through 130.3(a)3.

(a) **Controls for Sign Lighting.** All sign lighting shall meet the requirements below as applicable:

1. **Indoor Signs.** All indoor sign lighting other than exit 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 in addition to an automatic time-switch control, or an astronomical time-switch control.

      **EXCEPTION to Section 130.3(a)2A:** Outdoor signs in tunnels, and signs in large permanently covered outdoor areas that are intended to be continuously lit, 24 hours per day and 365 days per year.

   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 to Section 130.3(a)2B:** Outdoor signs in tunnels and large covered areas that are intended to be illuminated both day and night.
3. **Demand Responsive Electronic Message Center (EMC) Control.** See Section 110.12 for requirements for demand responsive EMC controls.~~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.~~

   ~~**EXCEPTION to Section 130.3(a)3:** Lighting for EMCs that is not permitted by a health or life safety statute, ordinance, or regulation to be reduced by 30 percent.~~

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to exempt licensed healthcare facilities from compliance with sign lighting control requirements. This exception is necessary because licensed healthcare facilities are now included in the scope of the Energy Code. This section has been identified as having the potential to interfere with the primary health and safety responsibilities of healthcare facilities since

sign lighting is necessary for directing emergency response, and where delay or confusion could harm patients.

Section 130.3(a)1 – The purpose of the change to this section is to exclude exit sign lighting from requirements for sign lighting to be controlled by time-switch controls. This clarification is necessary to prevent time-switch controls from shutting off exit sign illumination while occupants are still present in the building.

Section 130.3(a)3 – The purpose of the change to this section is to relocate demand response requirements for electronic message centers to Section 110.12. This is consistent with the effort to consolidate all demand response requirements in a single section.


Getty Images

Exit Signs – Exit signs are excluded from the sign lighting control requirements of the Energy Code.

# 130.4

## Lighting Control Acceptance and Installation Certificate Requirements

**CHANGE TYPE:** Clarification and Addition

**CHANGE SUMMARY:** Acceptance and installation documentation requirements for healthcare facilities were clarified, and requirements that were no longer relevant were removed.

**2019 CODE:**

Nonresidential buildings other than healthcare facilities, high-rise residential buildings, and hotel/motel buildings shall comply with the applicable requirements of Sections 130.4(a) through 130.4(c). Healthcare facilities shall comply with the applicable acceptance and installation documentation requirements of OSHPD.

[…]

(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:

[…]

3. ~~Certification that line-voltage track lighting integral current limiters comply with the applicable requirements of Section 110.9 and installed wattage has been determined in accordance with Section 130.0(c); and comply with Reference Nonresidential Appendix NA7.7.3.~~**Reserved**
4. ~~Certification that line-voltage track lighting supplementary overcurrent protection panels comply with the applicable requirements of Section 110.9 and installed wattage has been determined in accordance with Section 130.0(c); and comply with Reference Nonresidential Appendix NA7.7.4.~~**Reserved**

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to ensure consistency with inspection and documentation requirements for healthcare facilities overseen by the California Office of Statewide Health Planning and Development (OSHPD). The change clarifies without altering the requirements.

Section 130.4(b) – The purpose of the change to this section is to remove language requiring installation certificates for line-voltage track lighting current limiters and over-current protection panels. Classification of luminaire power requirements for line-voltage track lighting has been simplified in Section 130.0(c). Certificates of Installation are no longer necessary for verification of these devices.

# 130.5

## Electrical Power Distribution Systems

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** Language was added to exempt healthcare facilities from the electrical power distribution requirements, and the demand response requirements were relocated to Section 110.12.

**2019 CODE:**

Nonresidential, high-rise residential and hotel/motel buildings shall comply with the applicable requirements of Sections 130.5(a) through 130.5(e).

(a) **Service Electrical Metering.** Each electrical service or feeder shall have a permanently installed metering system which measures electrical energy use in accordance with TABLE 130.5-A.

**EXCEPTION 1 to Section 130.5(a):** Service or feeder for which the utility company provides a metering system that indicates instantaneous kW demand and kWh for a utility-defined period.

**EXCEPTION 2 to Section 130.5(a):** Electrical power distribution systems subject to *California Electrical Code* Article 517.

(b) **Separation of Electrical Circuits for Electrical Energy Monitoring.** Electrical power distribution systems shall be designed so that measurement devices can monitor the electrical energy usage of load types according to TABLE 130.5-B.

**EXCEPTION 1 to Section 130.5(b):** For each separate load type, up to 10 percent of the connected load may be of any type.

**EXCEPTION 2 to Section 130.5(b):** Electrical power distribution systems subject to *California Electrical Code* Article 517.

[…]

(d) **Circuit Controls for 120-Volt Receptacles and Controlled Receptacles.** In all buildings, both controlled and uncontrolled 120 volt receptacles shall be provided in office areas, lobbies, conference rooms, kitchen areas in office spaces, and copy rooms. Additionally, hotel/motel guest rooms shall comply with Section 130.5(d)4. Controlled receptacles shall meet the following requirements, as applicable:

[…]

**EXCEPTION 2 to Section 130.5(d):** Receptacles in healthcare facilities.

(e) **Demand responsive controls and equipment.** See Section 110.12 for requirements for demand responsive controls and equipment.~~Demand responsive controls and equipment, where installed, shall be capable of receiving and automatically responding to at least one standards-based messaging protocol which enables demand response after receiving a demand response signal.~~

**CHANGE SIGNIFICANCE:** Section 130.5(a), and (b), and Exception 2 to Section 130.5(d) – The purpose of the changes to these sections is to exempt licensed healthcare facilities from compliance with the service metering, separation of electrical circuits, and controlled receptacle requirements. These exceptions are necessary because licensed healthcare

facilities are now within the scope of the Energy Code. These sections have been identified as duplicating, and potentially conflicting, with existing requirements for healthcare facilities contained in the *California Electrical Code*, Article 517.

Section 130.5(e) – The purpose of the change to this section is to relocate demand response requirements into Section 110.12. This is consistent with the effort to consolidate all demand response requirements into a single section.

PART 5

# Nonresidential, High-Rise Residential and Hotel/Motel Occupancies—Performance and Prescriptive Compliance Approaches for Achieving Energy Efficiency

## Subchapter 5

Subchapter 5 defines the prescriptive and performance compliance approaches and establishes prescriptive requirements that are applicable to all buildings regulated by the Energy Code except low-rise residential buildings. This includes high-rise residential, nonresidential, hotel/motel buildings, and covered processes. This subchapter spans from Section 140.0 through 140.9. These sections establish all performance and prescriptive requirements for these buildings.

Sections 140.0 through 140.2 establish the performance and prescriptive compliance approaches, energy budgets, and designate Sections 140.3–140.9 as the sections that define prescriptive compliance with the Energy Code for nonresidential, high-rise residential, hotel/motel buildings, and covered processes.

Section 140.3 establishes prescriptive envelope requirements for building envelopes, including roofing product, insulation, fenestration, doors, air barriers, and requirements for relocatable public school buildings. Section 140.4 establishes prescriptive HVAC sizing, control, and efficiency requirements. Section 140.5 is where prescriptive water heating requirements are located. Sections 140.6 through 140.8 establish prescriptive requirements for indoor and outdoor lighting systems, and signs. Section 140.9 establishes prescriptive requirements for covered processes, including computer rooms, commercial kitchens, and laboratory and factory exhaust systems. ■

**140.3**

**Prescriptive Requirements for Building Envelopes**

**140.3(a)**

**Envelope Component Requirements**

**140.3**

**Prescriptive Requirements for Building Envelopes – Sizing**

**140.3(d)**

**Daylighting Design Power Adjustment Factors (PAFs)**

**140.4**

**Prescriptive Requirements for Space Conditioning Systems**

**140.4(a) and (b)**
Sizing and Equipment Selection, Calculations

**140.4(c)**
Fan Systems

**140.4(d)**
Space-Conditioning Zone Controls

**140.4(e)**
Economizers

**140.4(f)**
Supply Air Temperature Reset Controls

**140.4(g)**
Electric Resistance Heating

**140.4(h)**
Heat Rejection Systems

**140.4(j)**
Limitation of Air Cooled Chillers

**140.4(k)4**
Hydronic System Measures

**140.4(l)**
Air Distribution System Duct Leakage Sealing

**140.4(m)**
Fan Control

**140.4(n)**
Mechanical System Shut-off

**140.6**
Prescriptive Requirements for Indoor Lighting

**140.6(a)**
Calculation of Adjusted Indoor Lighting Power

**140.6(a)1**
Two Interlocked Systems

**140.6(a)2**
Reduction of Wattage Through Controls

**140.6(a)3**
Lighting Wattage Excluded

**140.6(a)4**
Luminaire Classification and Power Adjustment

**140.6(c)**
Calculation of Allowed Indoor Lighting Power: Specific Methodologies

**140.6(c)2**
Area Category Method

**140.6(c)3**
Tailored Method

**140.6(d)**
Automatic Daylighting Controls in Secondary Daylit Zones

**140.7**
Prescriptive Requirements for Outdoor Lighting

**TABLES 140.7-A and 140.7-B**
Lighting Power Allowances

**140.8**
Prescriptive Requirements for Signs

**140.8(b)**
Alternate Lighting Sources

**140.9**
Prescriptive Requirements for Covered Processes

**140.9(a)**
Prescriptive Requirements for Computer Rooms

**140.9(b)**
Prescriptive Requirements for Kitchens

**140.9(c)**
Prescriptive Requirements for Laboratory and Factory Exhaust Systems

# 140.3(a)

## Envelope Component Requirements

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** Requirements for fenestration in demising walls were modified to only require maximum *U*-factor efficiency values.

**2019 CODE:**

(a) **Envelope Component Requirements.**

[…]

3. **Demising Walls.** Demising walls shall meet the requirements of Section 120.7(b)7. Vertical windows in demising walls between conditioned and unconditioned spaces shall have an area-weighted average *U*-factor no greater than the applicable value in TABLE 140.3-B, C or D.

[…]

**NOTE:** Demising walls are not exterior walls, and therefore windows in demising walls are not subject to SHGC requirements.

[…]

**NOTE:** Demising walls are not exterior walls, and therefore windows in demising walls are not subject to VT requirements.

**CHANGE SIGNIFICANCE:** Windows in demising walls that separate conditioned space from unconditioned space must continue to meet the fenestration *U*-factor requirements in prescriptive Table 140.3-B, C, or D. Windows in demising walls do not have to meet the requirements for solar heat gain coefficient (SHGC) or visible transmittance (VT), as they do not experience the same solar exposure as windows in exterior walls.

Getty Images

Fenestration in Demising Walls – This fenestration no longer has SHGC or VT requirements.

# 140.3(d)

## Daylighting Design Power Adjustment Factors (PAFs)

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** The purpose of the addition of this section and its associated table and equation is to provide power adjustment factors (PAFs) for clerestory fenestration, horizontal slats, and light shelves that may have the effect of reducing electrical lighting loads by increasing use of natural daylight.

**2019 CODE:**

(d) **Daylighting Design Power Adjustment Factors (PAFs).** To qualify for a Power Adjustment Factor (PAF) as specified in Section 140.6(a)2L, daylighting devices shall meet the following requirements:

1. **Clerestory Fenestration.** To qualify for a PAF, clerestory fenestration shall meet the following requirements:
   - A. Shall be installed on east-, west-, or south-facing facades.
   - B. Shall have a head height that is at least 10 feet above the finished floor.
   - C. Shall have a glazing height that is greater than or equal to 10 percent of the head height.
   - D. If operable shading is installed on the clerestory fenestration, then the clerestory fenestration shading shall be controlled separately from shading serving other vertical fenestration.
2. **Interior and Exterior Horizontal Slats.** To qualify for a PAF, horizontal slats shall meet the following requirements:
   - A. Shall be installed adjacent to vertical fenestration on east- or west-facing facades with Window Wall Ratios between 20 and 30 percent, and extend to the entire height of the vertical fenestration.
   - B. Exterior horizontal slats shall be level or sloped downwards from fenestration. Interior horizontal slats shall be level or sloped upwards from fenestration.
   - C. Shall have a projection factor as specified in Table 140.3-E. The projection factor is calculated using EQUATION 140.3-E.
   - D. Shall have a minimum Distance Factor of 0.3. The distance factor is calculated using EQUATION 140.3-E.

     **EXCEPTION to Section 140.3(d)2D:** Where it is documented that existing adjacent structures or natural objects within view of the vertical fenestration block direct sunlight onto the vertical fenestration between 8 a.m. and 5 p.m. for less than 500 daytime hours per year.
   - E. Shall have a minimum Visible Reflectance of 0.50 when tested as specified in ASTM E903.
   - F. Shall be opaque.

     **EXCEPTION to Section 140.3(d)2F:** Horizontal slats with a Visible Transmittance of 0.03 or less when tested as specified in ASTM E1175.
   - G. Shall be permanently mounted and not adjustable.

H. Shall extend beyond each side of the window jamb by a distance equal to or greater than their horizontal projection.

**EXCEPTION to Section 140.3(d)2H:** Where the slats are located entirely within the vertical fenestration's rough opening or a fin is located at the window jambs and extends vertically the entire height of the window jamb and extends horizontally the entire depth of the projection.

I. Shall be shown on the plans with the dimensions for the slat projection and slat spacing as specified in EQUATION 140.3-E.

J. Shall have a conspicuous factory installed label permanently affixed and prominently located on an attachment point of the device to the building envelope, stating the following: "NOTICE: Removal of this device will require re-submittal of compliance documentation to the enforcement agency responsible for compliance with California Title 24, Part 6".

3. **Interior and Exterior Light Shelves.** To qualify for a PAF, light shelves shall meet the following requirements:

A. Where there is vertical fenestration area below the light shelf, both interior and exterior light shelves shall be installed.

B. Shall be installed adjacent to clerestory fenestration on south-facing facades with Window Wall Ratios greater than 30 percent. The head height of the light shelves shall be no more than one foot below the finished ceiling. The clerestory fenestration shall meet the requirements of Section 140.3(d)1.

C. Shall be level or sloped based on their installation. Exterior light shelves shall be level or sloped downwards from fenestration. Interior light shelves shall be level or sloped upwards from fenestration.

D. Shall have a projection factor of the applicable value as specified in Table 140.3-E. The light shelf projection factor is calculated using EQUATION 140.3-E.

E. Shall have a minimum Distance Factor of 0.3. The distance factor is calculated using EQUATION 140.3-E.

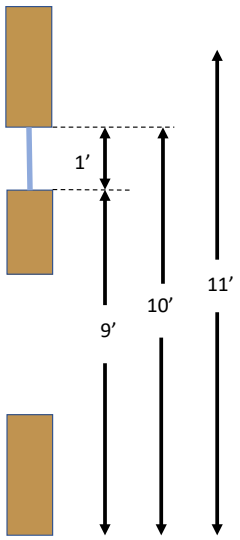
**EXCEPTION to Section 140.3(d)3E:** Where it is documented that existing adjacent structures or natural objects within view of the vertical fenestration block direct sunlight onto the vertical fenestration between 8 a.m. and 5 p.m. for less than 750 daytime hours per year.

F. Shall have a top surface with a minimum Visible Reflectance of 0.50 when tested as specified in ASTM E903.

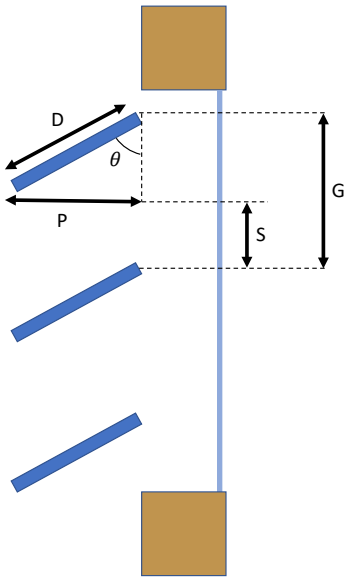
**EXCEPTION to Section 140.3(d)3F:** Where an exterior light shelf is installed greater than two feet below the clerestory sill.

G. Shall extend beyond each side of the window jamb by a distance equal to or greater than their horizontal projection.

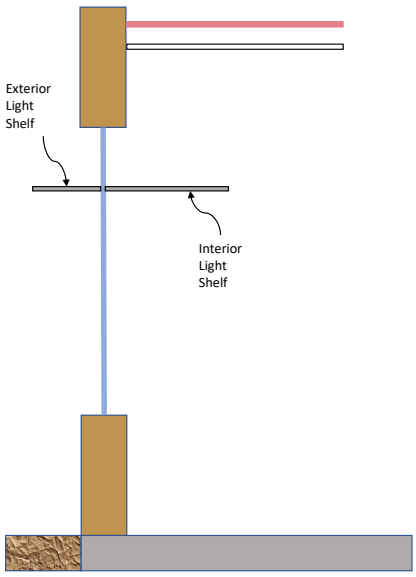
H. Shall be shown on the plans with the dimensions for the light shelf projection and light shelf spacing as specified in EQUATION 140.3-E.




Clerestory – To qualify for a lighting power adjustment factor, clerestory fenestration must meet the requirements of Section 140.6(d)1.
Source: California Energy Commission




Horizontal Slats – To qualify for a lighting power adjustment factor, horizontal slats must meet the requirements of Section 140.6(d)2.
Source: California Energy Commission




Lighting Shelves – To qualify for a lighting power adjustment factor, lighting shelves must meet the requirements of Section 140.6(d)2.
Source: California Energy Commission

**TABLE 140.3-E Daylighting Devices**

| DAYLIGHTING DEVICE | ORIENTATION OF THE VERTICAL FENESTRATION | PROJECTION FACTOR |
|---|---|---|
| Horizontal Slats | East or West | 2.0 to 3.0 |
| Interior Light Shelf | South | 1.0 to 2.0 |
| Interior Light Shelf | South | 0.25 to 1.25 |

**EQUATION 140.3-E PROJECTION AND DISTANCE FACTOR CALCULATION**

Projection Factor = Projection / Spacing

Distance Factor = $D / (H_{AS} \times$ Projection Factor)

Where:

Projection = The horizontal distance between the base edge and the projected edge of the slat or light shelf.

Spacing = For horizontal slats, the vertical distance between the projected edge of a slat to the base edge of the slat below

For interior light shelves, the vertical distance between the projected edge of the light shelf and head of the clerestory fenestration above it.

For exterior light shelves, the vertical distance between the projected edge of the light shelf and sill of the vertical fenestration below it.

$D$ = Distance between the existing structure or nature object and the fenestration

$H_{AS}$ = Height difference between the top of the existing structure or nature object and the bottom of the fenestration

**NOTE:** The base edge is the edge of a slat or light shelf that is adjacent to the vertical fenestration. The projected edge is the opposite edge from the base edge.

**CHANGE SIGNIFICANCE:** The purpose of the addition of Section 140.3(d), Table 140.3-E, and Equation 140.3-E is to provide power adjustment factors (PAFs) to daylighting equipment that has the effect of reducing electrical lighting loads by increasing use of natural light. The installation of clerestory fenestration, horizontal slats, and light shelves coupled with automatic daylighting controls serving the associated daylit zones can provide indoor lighting energy savings.

# 140.4(a) and (b)

## Sizing and Equipment Selection, Calculations

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Space conditioning equipment sizing and load calculation requirements were updated for the inclusion of healthcare facilities into the scope of the Energy Code.

**2019 CODE:**

(a) **Sizing and Equipment Selection.** Mechanical heating and mechanical cooling equipment serving healthcare facilities shall be sized to meet the design heating and cooling loads as calculated according to the subsection (b). Mechanical heating and mechanical cooling equipment serving high-rise residential buildings, hotel/motel buildings and nonresidential buildings other than healthcare facilities, 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).

[…]

(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~~1. **Heating and cooling loads.** Heating and cooling system design loads shall be determined in accordance with the procedures described in subsection A or B below:

A. For systems serving high-rise residential buildings, hotel/motel buildings, and nonresidential buildings other than healthcare facilities, the method in the 2017 ASHRAE Handbook, Fundamentals shall be used~~Volume,~~ or as specified in a method approved by the Commission.

B. For system serving healthcare facilities the method in the *California Mechanical Code* shall be used.

~~3~~2. **Indoor design conditions.** Indoor design temperature and humidity conditions for ~~general~~ comfort applications shall be determined in accordance with subsection A or B below:

A. For systems serving high-rise residential buildings, hotel/motel buildings, and nonresidential buildings other than healthcare facilities, ASHRAE Standard 55 or the 2017 ASHRAE Handbook, Fundamentals Volume, ~~Chapter 8,~~ except that winter humidification and summer dehumidification shall not be required.

B. For system serving healthcare facilities the method in Section 320.0 of the *California Mechanical Code* shall be used.

~~4~~3. **Outdoor design conditions.** Outdoor design conditions shall be selected in accordance with subsection A or B below:

A. For systems serving high-rise residential buildings, hotel/motel buildings, and nonresidential buildings other than healthcare facilities the design conditions from Reference Joint Appendix JA2 shall be used, 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.

B. For system serving healthcare facilities the method in Section 320.0 of the *California Mechanical Code* shall be used.

**EXCEPTION to Section 140.4(b)~~4~~3:** Cooling design temperatures for cooling towers shall be no greater than the 0.5 percent Cooling Design Wet bulb values.

~~5~~4. **Ventilation.** Outdoor air ventilation loads shall be calculated using the ventilation rates required in Section 120.1(c)3.

~~6~~5. **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.

6~~7~~. **Lighting.** Lighting heating and cooling loads shall be based on actual design lighting levels or power densities as specified in Section 140.6.

7~~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~~c)3A~~2B~~, if used. Sensible and latent heat gains shall be as listed in the 2017~~05~~ ASHRAE Handbook- Fundamentals, Chapter 18.~~30, Table 1.~~

8~~9~~. **Process loads.** Loads caused by a process shall be based upon actual information on the intended use of the building.

9~~10~~. **Miscellaneous equipment.** Equipment loads other than process 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 or 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.

10~~11~~. **Internal heat gains.** Internal heat gains may be ignored for heating load calculations.

11~~12~~. **Safety factor.** Calculated ~~D~~ddesign loads based on 140.4(b)1 through 10 may be increased by up to 10 percent to account for unexpected loads or changes in space usage.

12~~13~~. **Other loads.** Loads such as warm-up or cool-down shall be calculated from principles based on the ~~heat~~ thermal 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. In addition, the steady-state load may include a safety factor in accordance with Section 140.4(b)11~~12~~.

**CHANGE SIGNIFICANCE:** Healthcare facilities were added to the scope of the 2019 Energy Code. They have many unique mechanical design

requirements to meet the many complex needs of patient care. The changes in this section were needed to ensure that the Energy Code does not conflict with other code requirements related to healthcare facilities.

Changes in this section relieve healthcare facility designers from the requirement to use the smallest size mechanical equipment within the desired equipment line to meet heating and cooling loads. The *California Mechanical Code* already addresses load calculations for healthcare facilities, so language was added to direct designers to the methods described there. For systems serving high-rise residential buildings, hotel/motel buildings, and nonresidential buildings other than healthcare facilities, designers are directed to the methods described in the 2017 ASHRAE Handbook, Fundamentals. Although the new language does not add or change existing design and sizing calculations for healthcare facilities, it does continue to require the calculations to be performed.

# 140.4(c)

## Fan Systems

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** The modification to this section aligns space conditioning fan system requirements more closely with the fan system power allowances of ASHRAE 90.1-2016.

**2019 CODE:**

(c) **~~Power Consumption of~~ Fans Systems.** Each fan system having a total fan system motor nameplate horsepower exceeding 5 hp used for space conditioning shall meet the requirements of Items 1, 2, ~~3~~ and ~~4~~3 below. 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 (i) 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 (ii) 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.~~

1. **Fan Power Limitation.** At design conditions each fan system shall not exceed the allowable fan system power of option 1 or 2 as specified in Table 140.4-A

**TABLE 140.4-A Fan Power Limitation**

| | LIMIT | CONSTANT VOLUME | VARIABLE VOLUME |
|---|---|---|---|
| Option 1: Fan system motor nameplate hp | Allowable motor nameplate hp | $hp \le cfm_s \times 0.0011$ | $hp \le cfm_s \times 0.0015$ |
| Option 2: Fan system bhp | Allowable fan system bhp | $bhp \le cfm_s \times 0.00094 + A$ | $bhp \le cfm_s \times 0.0013 + A$ |

$cfm_s$ = maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute

hp = maximum combined motor nameplate horsepower for all fans in the system

bhp = maximum combined fan-brake horsepower for all fans in the system

A = sum of (PD × $cfm_D$/4131)

PD = each applicable pressure drop adjustment from Table 140.4-B, in inches of water

$cfm_D$ = the design airflow through each applicable device from Table 140.4-B, in cubic feet per minute

**TABLE 140.4-B Fan Power Limitation Pressure Drop Adjustment**

| DEVICE | ADJUSTMENT CREDITS |
|---|---|
| Return or exhaust systems required by code or accreditation standards to be fully ducted, or systems required to maintain air pressure differentials between adjacent rooms | 0.5 in. of water |
| Return and/or exhaust airflow control devices | 0.5 in. of water |
| Exhaust filters, scrubbers, or other exhaust treatment | The pressure drop of device calculated at fan system design condition |
| Particulate Filtration Credit: MERV 16 and greater and electronically enhanced filters | Pressure drop calculated at 2 × clean filter pressure drop at fan system design condition |
| Carbon and other gas-phase air cleaners | Clean filter pressure drop at fan system design condition |
| Biosafety cabinet | Pressure drop of device at fan system design condition |
| Energy recovery device, other than coil runaround loop | For each airstream [(2.2 × Energy Recovery Effectiveness) – 0.5] in. of water |
| Coil runaround loop | 0.6 in. of water for each airstream |
| Exhaust systems serving fume hoods | 0.35 in. of water |

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~~A. 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 Section140.4(c)2CB. If this results in the sensor being located downstream of any major duct split, multiple sensors shall be installed in each major branch with fan capacity controlled to satisfy the sensor furthest below its setpoint; and

B~~C~~. Setpoint Reset. For systems with direct digital control of individual zone boxes reporting to the central control panel, static pressure setpoints shall be reset based on the zone requiring the most pressure; i.e., the setpoint 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 total adjusted fan power index using Equation 140.4-A:~~

~~EQUATION 140.4-A ADJUSTED TOTAL FAN POWER INDEX~~

~~Adjusted total fan power index = Fan power index × Fan Adjustment~~

~~Fan Adjustment =~~ $1-\left(\frac{SP_a-1}{SP_f}\right)$

~~WHERE:~~

~~SPa = Air pressure drop across the air-treatment or filtering system.~~

~~SPf = Total pressure drop across the fan.~~

~~4~~3. **Fractional HVAC Motors for Fans.** HVAC motors for fans that are less than 1 hp 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. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of a varying motor speed.

**EXCEPTION 1 to Section 140.4(c)43:** Motors in fan-coils and terminal units that operate only when providing heating to the space served.

**EXCEPTION 2 to Section 140.4(c)43:** Motors in space conditioning equipment certified under Section 110.1 or 110.2.

**EXCEPTION 1 to 140.4(c):** Fan system power caused solely by process loads.

**EXCEPTION 2 to 140.4(c):** Systems serving healthcare facilities.

**CHANGE SIGNIFICANCE:** The modifications to this section set new fan power limits for fan systems over 5 horsepower. The new requirement is in direct alignment with the fan power limits of ASHRAE 90.1-2016, which result in energy savings due to higher efficiency fan systems. This modification allows two options for fan system design. Option 1 calculates the maximum horsepower based on design airflow and total nameplate horsepower. Option 2 is based on design airflow and break horsepower, which includes adjustments to account for special filtering (or other devices) in the airstream that increase the static pressure the fan must overcome.

# 140.4(d)

## Space-Conditioning Zone Controls

**CHANGE TYPE:** Clarification and Addition

**CHANGE SUMMARY:** Language in Exception 1 to Section 140.4(d) was incorporated directly into the space-conditioning zone controls requirements language of this section, and an exception was added for healthcare facilities.

**2019 CODE:**

(d) **Space-conditioning Zone Controls.** Each space-conditioning zone shall have controls designed in accordance with 1 or 2:

1. Each space-conditioning zone shall have controls that prevent:
   ~~1.~~A. Reheating; and
   ~~2.~~B. Recooling; and
   ~~3.~~C. 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~~.~~; or
2. Zones served by variable air-volume systems that are designed and controlled to reduce, to a minimum, the volume of reheated, recooled, or mixed air are allowed only if the controls meet all of the following requirements:
   A. For each zone with direct digital controls (DDC):
      i. The volume of primary air that is reheated, recooled 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 as specified by Section 120.1(c)3.
      ii. The volume of primary air 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 as specified by Section 120.1(c)3.
      iii. The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no higher than 95ºF while the airflow is maintained at the deadband flow rate.
      iv. The second stage of heating consists of modulating the airflow rate from the deadband flow rate up to the heating maximum flow rate.
   B. For each zone without DDC, the volume of primary air that is reheated, re-cooled, or mixed air supply shall not exceed the larger of the following:
      i. 30 percent of the peak primary airflow; or
      ii. The design zone outdoor airflow rate as specified by Section 120.1(c)3.

~~**EXCEPTION 1 to Section 140.4(d):** Zones served by variable air-volume systems that are designed and controlled to reduce, to a minimum, the volume of reheated, recooled, or mixed air are allowed only if the controls meet all of the following requirements:~~

~~A. For each zone with direct digital controls (DDC):~~

~~i. The volume of primary air that is reheated, recooled 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 as specified by Section 120.1.~~

~~ii. The volume of primary air 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 as specified by Section 120.1.~~

~~iii. The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no higher than 95°F while the airflow is maintained at the dead band flow rate.~~

~~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 air that is reheated, re-cooled, or mixed air supply shall not exceed the larger of the following:~~

~~i. 30 percent of the peak primary airflow; or~~

~~ii. The design zone outdoor airflow rate as specified by Section 120.1.~~

**EXCEPTION ~~2~~1 to Section 140.4(d):** Zones with special pressurization relationships or cross-contamination control needs.

**EXCEPTION ~~3~~2 to Section 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~~3 to Section 140.4(d):** Zones in which specific humidity levels are required to satisfy exempt process loads. Computer rooms or other spaces where the only process load is from IT equipment may not use this exception.

**EXCEPTION ~~5~~4 to Section 140.4(d):** Zones with a peak supply-air quantity of 300 cfm or less.

**EXCEPTION 5 to Section 140.4(d):** Systems serving healthcare facilities.

**CHANGE SIGNIFICANCE:** This section has been updated by incorporating Exception 1 language directly into the section language to improve the clarity of the space-conditioning zone control requirements for reheating and recooling.

Exception 5 has been added to this section to exempt licensed healthcare facilities from compliance with these space-conditioning zone control design requirements. This exception is necessary because licensed healthcare facilities are being brought into the scope of the Energy Code for the first time, but this section has been identified as having the potential to interfere with the primary health and safety responsibilities of healthcare facilities, since healthcare facilities have strict ventilation design requirements necessary for infection control. Future code cycles may remove this exception based on more detailed analysis and/or partial exceptions tailored specifically for healthcare facilities.

# 140.4(e)

## Economizers

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** Chilled-water cooling systems without a fan and chilled-water cooling systems that use induced airflow were added to the scope of this section.

**2019 CODE:**

(e) **Economizers.**

1. Each cooling air handler that has a design total mechanical cooling capacity over 54,000 Btu/hr, or chilled-water cooling systems without a fan or that use induced airflow that has a cooling capacity greater than the systems listed in Table 140.4-C, 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 and 45°F wet-bulb and below.

**EXCEPTION 1 to Section 140.4(e)1:** Where special outside air filtration and treatment, for the reduction and treatment of unusual outdoor contaminants, makes compliance infeasible.

**EXCEPTION 2 to Section 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 140.4(e)1:** Systems serving high-rise residential living quarters and hotel/motel guest rooms.

**EXCEPTION 4 to Section 140.4(e)1:** Where comfort cooling systems have the cooling efficiency that meets or exceeds the cooling efficiency improvement requirements in TABLE 140.4-D~~A~~.

**EXCEPTION 5 to Section 140.4(e)1:** Fan systems primarily serving computer rooms. See Section 140.9(a) for computer room economizer requirements.

**EXCEPTION 6 to Section 140.4(e)1:** Systems design to operate at 100 percent outside air at all times.

**TABLE 140.4-C Chilled Water System Cooling Capacity**

| Climate Zones | Total Building Chilled Water System Capacity, Minus Capacity of the Cooling units with Air Economizers | |
|---|---|---|
| | Building Water-Cooled Chilled Water System | Air-Cooled Chilled Water Systems or District Chilled Water Systems |
| 15 | ≥ 960,000 Btu/h (280 kW) | ≥ 1,250,000 Btu/h (365 kW) |
| 1-14 | ≥ 720,000 Btu/h (210 kW) | ≥ 940,000 Btu/h (275 kW) |
| 16 | ≥ 1,320,000 Btu/h (385 kW) | ≥ 1,720,000 Bu/h (505 kW) |

[...]

3. Systems that include a water economizer to meet Section 140.4(e)1 shall include the following:

   A. Maximum pressure drop. Precooling coils and water-to-water heat exchangers used as part of a water economizer shall either have a waterside pressure drop of less than 15 feet of water, or a secondary loop shall be installed so that the coil or heat exchanger pressure drop is not contributing to pressure drop when the system is in the normal cooling (non-economizer) mode.

   B. Economizer systems shall be integrated with the mechanical cooling system so that they are capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load. Controls shall not false load the mechanical cooling system by limiting or disabling the economizer or by any other means, such as hot gas bypass, except at the lowest stage of mechanical cooling.

**CHANGE SIGNIFICANCE:** Section 140.4(e)1 and Table 140.4-C – The purpose of this change is to extend the economizing requirement to chilled-water mechanical systems that do not incorporate an indoor supply air fan system for cooling. Table 140.4-C is a new table that lists the system capacities where water economizing is feasible and applicable to the new requirements.

The reference in Section 140.4(e)1B to an equipment sizing calculation method approved by the Commission was removed to eliminate redundancy. Section 140.4(b) already details the calculation method.

Exception 6 to Section 140.4(e)1 was added for intrinsically economizing systems to prevent installation of economizing equipment in circumstances where it will provide no added benefit.

Section 140.4(e)2 – Sections 140.4(e)3, 4, and 5 were consolidated into Section 140.4(e)2 to keep the requirements for air economizers in one section.

Section 140.4(e)3 – This new section adds requirements for chilled water economizing systems to eliminate or highly reduce the impact of the pumping power needed for an added heat exchanger, and piping of a water economizer system.

# 140.4(f)

## Supply Air Temperature Reset Controls

**CHANGE TYPE:** Modification and Addition

**CHANGE SUMMARY:** Restrictive language was removed, and an exception to the supply air temperature reset control requirements was added for healthcare facilities.

**2019 CODE:**

(f) **Supply Air Temperature Reset Controls.** Space-conditioning systems supplying heated or cooled air to multiple zones shall include controls that automatically reset supply-air temperatures. Air distribution systems serving zones that are likely to have constant loads~~, such as interior zones~~, shall be designed for the airflows resulting from the fully reset supply air temperature. Supply air temperature reset controls shall be:

1. In response to representative building loads or to outdoor air temperature; and
2. At least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

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

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

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

**EXCEPTION 4 to Section 140.4(f):** Systems serving healthcare facilities.

**CHANGE SIGNIFICANCE:** Section 140.4(f) – The removal of the language "such as interior zones" removes an example that is not intended to be regulated, and thereby removes any potential confusion.

Exception 1 to Section 140.4(f) – The change to this exception is needed to align with the change to Section 140.4(d) that moved its first exception into the section language, and renumbered previous exceptions.

Exception 4 to Section 140.4(f) – This exception exempts licensed healthcare facilities from supply air temperature reset control requirements. This is necessary because this section has been identified as having the potential to interfere with strict ventilation design requirements necessary for infection control of healthcare facilities.

# 140.4(g)

## Electric Resistance Heating

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Redundant language was removed from an exception, and a new exception was added to allow emergency backup heating systems to have electric resistance heating.

**2019 CODE:**

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

[…]

**EXCEPTION 5 to Section 140.4(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.~~

**EXCEPTION 6 to Section 140.4(g):** heating systems serving as emergency backup to gas heating equipment.

**CHANGE SIGNIFICANCE:** Exception 5 to Section 140.4(g) – The 2019 Energy Code added a definition for "natural gas availability." As a result, the language in this exception was shortened.

Exception 6 to Section 140.4(g) – This exception was added to allow emergency backup space heating systems to use electric resistance heating. This avoids prohibiting equipment that will only be used for an extremely limited time, and only during emergency situations where the ability to operate on electric resistance may provide specific benefits.

# 140.4(h)

## Heat Rejection Systems

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** The language and paragraph structure in this section was reorganized, and a prescriptive pump efficiency requirement was added for cooling towers with a pumping capacity of 900 gallons per minute (gpm) or more.

**2019 CODE:**

(h) **Heat Rejection Systems.**~~1. **Scope.** Subsection 140.4(h) applies to h~~Heat rejection equipment used in comfort cooling systems, such as air-cooled condensers, open cooling towers, closed-circuit cooling towers, and evaporative condensers shall include the following~~.~~:

[…]

5. **Cooling tower efficiency.** Axial fan, open-circuit cooling towers serving condenser water loops for chilled water plants with a total of 900 gpm or greater, shall have a rated efficiency of no less than 60 gpm/hp when rated in accordance with the conditions as listed in Table 110.2-G.

**EXCEPTION 1 to Section 140.4(h)5:** Replacement of existing cooling towers that are inside an existing building or on an existing roof.

**EXCEPTION 2 to Section 140.4(h)5:** Cooling towers serving buildings in Climate Zone 1 or 16.

**CHANGE SIGNIFICANCE:** Section 140.4(h) – The main purpose of the changes to this section are to add a prescriptive efficiency requirement of 60 gpm/hp for cooling towers with a pumping capacity over 900 gpm. The language and the paragraph structure of this section were modified to simplify and add clarity.

Exception 1 to Section 140.4(h)5 – This exception was added for the replacement of existing towers located inside or on the roof of an existing building because of the physical limitations that may exist with existing structures to accommodate a larger and heavier tower.

Exception 2 to Section 140.4(h)5 – This exception was added for Climate Zones 1 and 16, where it is not cost effective to install these more expensive higher efficient cooling towers.

# 140.4(j)

## Limitation of Air Cooled Chillers

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** An exception for chillers approved by the Commission was removed to eliminate redundancy, and an exception for healthcare facilities was added.

**2019 CODE:**

(j) **Limitation of Air-Cooled Chillers.** Chilled water plants shall not have more than 300 tons provided by air-cooled chillers.

**EXCEPTION 1 to Section 140.4(j):** Where the water quality at the building site fails to meet manufacturer's specifications for the use of water-cooled chillers.

**EXCEPTION 2 to Section 140.4(j):** Chillers that are used to charge a thermal energy storage system with a design temperature of less than 40° ~~degrees~~ F (4° ~~degrees~~ C).

~~**EXCEPTION 3 to Section 140.4(j):** Air cooled chillers with minimum efficiencies approved by the Commission pursuant to Section 10-109(d).~~

**EXCEPTION 3 to Section 140.4(j):** Systems serving healthcare facilities.

**CHANGE SIGNIFICANCE:** Exception 3 to Section 140.4(j) – This exception for chillers approved by the Commission was removed because it was redundant. Section 10-109 of the Administrative Code (Part 1) lays out a general framework for determining "alternate component packages," and applies to the entirety of the Energy Code.

Exception 3 to Section 140.4(j) – An exception for healthcare facilities is added because this section has been identified as either having the potential to interfere with the primary health and safety responsibilities of healthcare facilities, or the potential to not be cost effective when applied to a healthcare facility.

# 140.4(k)4

## Hydronic System Measures

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** An exception for healthcare facilities was added for chilled and hot water temperature reset controls for hydronic systems.

**2019 CODE:**

(k) **Hydronic System Measures**

[…]

4. **Chilled and Hot Water Temperature Reset Controls.** Systems with a design capacity exceeding 500,000 Btu/hr supplying chilled or heated water shall include controls that automatically reset supply water temperatures as a function of representative building loads or outside air temperature.

   **EXCEPTION 1 to Section 140.4(k)4:** Hydronic systems that use variable flow to reduce pumping energy in accordance with Section 140.4(k)1.

   **EXCEPTION 2 to Section 140.4(k)4:** Systems serving healthcare facilities.

   […]

**CHANGE SIGNIFICANCE:** The purpose of this new exception is to exempt licensed healthcare facilities from compliance with the chilled and hot water temperature reset controls requirements for hydronic systems. This exception is necessary because healthcare facilities have specific hot and chilled water needs to support health and safety. This requirement has been identified as having the potential to interfere with the health and safety of patients.

# 140.4(l)

## Air Distribution System Duct Leakage Sealing

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** This section was restructured for the addition and isolation of unique healthcare facility duct sealing requirements.

**2019 CODE:**

(l) **Air Distribution System Duct Leakage Sealing.** Duct systems shall be sealed in accordance with 1 or 2 below:

1. Systems serving high-rise residential buildings, hotel/motel buildings and nonresidential buildings other than healthcare facilities, the duct system shall be sealed to a leakage rate not to exceed 6 percent of the nominal air handler airflow rate as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures in Reference Nonresidential Appendices NA1 and NA2 if the criteria in Subsections ~~1~~A, ~~2~~B and ~~3~~C below are met:

   ~~1~~A. The duct system provides conditioned air to an occupiable space for a constant volume, single zone, space-conditioning system; and

   ~~2~~B. The space conditioning system serves less than 5,000 square feet of conditioned floor area; and

   ~~3~~C. The combined surface area of the ducts located in the following spaces is more than 25 percent of the total surface area of the entire duct system:

      ~~A~~i. Outdoors; or

      ~~B~~ii. In a space directly under a roof that

         a. Has a *U*-factor greater than the *U*-factor of the ceiling, or if the roof does not meet the requirements of Section 140.3(a)1B, or

         b. Has fixed vents or openings to the outside or unconditioned spaces, or

      ~~C~~iii. In an unconditioned crawl space, or

      ~~D~~iv. In other unconditioned spaces.

2. Duct systems serving healthcare facilities shall be sealed in accordance with the *California Mechanical Code.*

**CHANGE SIGNIFICANCE:** The changes to this section are needed to isolate the unique requirements for duct sealing in healthcare facilities. Healthcare facilities are new to the scope of the Energy Code, but duct sealing requirements for these facilities have been included in the Mechanical Code for some time. The change to this section defers healthcare facility duct sealing requirements to the Mechanical Code while maintaining Energy Code duct sealing requirements for all other building types.

# 140.4(m)

## Fan Control

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** An exception to the fan control requirements in this section was added for healthcare facilities, and Table 140.4-D was changed to Table 140.4-G to account for changes in other sections.

**2019 CODE:**

(m) **Fan Control.** Each cooling system listed in TABLE 140.4-G~~D~~ shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements:

1. DX and chilled water cooling systems that control the capacity of the mechanical cooling directly based on occupied space temperature shall (i) have a minimum of 2 stages of fan control with no more than 66 percent speed when operating on stage 1; and (ii) draw no more than 40 percent of the fan power at full fan speed, when operating at 66 percent speed.
2. All other systems, including but not limited to DX cooling systems and chilled water systems that control the space temperature by modulating the airflow to the space, shall have proportional fan control such that at 50 percent airflow the power draw is no more than 30 percent of the fan power at full fan speed.
3. Systems that include an air side economizer to meet 140.4(e)1 shall have a minimum of two speeds of fan control during economizer operation.

**EXCEPTION 1 to Section 140.4(m):** Modulating fan control is not required for chilled water systems with all fan motors < 1 HP, or for evaporative systems with all fan motors < 1 HP, if the systems are not used to provide ventilation air and all indoor fans cycle with the load.

**EXCEPTION 2 to Section 140.0(m):** Systems serving healthcare facilities.

**TABLE 140.4-~~D~~G Fan Control Systems**

| Cooling System Type | Fan Motor Size | Cooling Capacity |
|---|---|---|
| DX cooling | any | ≥ 65,000 Btu/hr |
| Chilled water and evaporative | ≥ 1/4 HP | any |

**CHANGE SIGNIFICANCE:** An exception to the fan control requirements of this section is added for licensed healthcare facilities. This section has been identified as having the potential to interfere with the primary health and safety responsibilities of healthcare facilities which have strict ventilation design requirements necessary for infection control.

# 140.4(n)

## Mechanical System Shut-off

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Exceptions for the mechanical shut-off requirements were added for healthcare facilities and high-rise residential dwelling units.

**2019 CODE:**

(n) **Mechanical System Shut-off.** Any directly conditioned space with operable wall or roof openings to the outdoors shall be provided with interlock controls that disable or reset the temperature setpoint to 55°F for mechanical heating and disable or reset the temperature setpoint to 90°F for mechanical cooling to that space when any such opening is open for more than 5 minutes.

**EXCEPTION 1 to Section 140.4(n):** Interlocks are not required on doors with automatic closing devices.

**EXCEPTION 2 to Section 140.4(n):** Any space without a thermostatic control (thermostat or a space temperature sensor used to control heating or cooling to the space).

**EXCEPTION 3 to Section 140.4(n):** Healthcare facilities.

**EXCEPTION 4 to Section 140.4(n):** High-rise residential dwelling units.

**CHANGE SIGNIFICANCE:** Exception 3 to Section 140.4(n) – This exception exempts licensed healthcare facilities from compliance with the mechanical space conditioning system shut-off requirements. This exception is necessary because this section has been identified as having the potential to interfere with the strict ventilation design requirements in healthcare facilities necessary for infection control.

Exception 4 to Section 140.4(n) – This exception exempts high-rise residential dwelling units from compliance with the mechanical space conditioning system shut-off requirements. The analysis for this requirement focused on commercial spaces and did not include high-rise residential spaces for this control scheme.

# 140.6(a)1

## Calculation of Adjusted Indoor Lighting Power, Two Interlocked Systems

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** Terminology within Section 140.6 was updated, and an exception which was no longer necessary was removed.

**2019 CODE:**

**SECTION 140.6 – PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING**

A building complies with this section if:

i. The Calculation of ~~Actual~~ Adjusted Indoor Lighting Power of all proposed building areas combined, calculated under Subsection (a) is no greater than the Calculation of Allowed Indoor Lighting Power, Specific Methodologies calculated under Subsection (c); and

ii. The Calculation of Allowed Indoor Lighting Power, General Rules comply with Subsection (b); and

iii. General lighting complies with the Automatic Daylighting Controls in Secondary Daylit Zone requirements in Subsection (d).

The prescriptive limits on indoor lighting power are the smaller of the Actual and Allowed Indoor Lighting Power values determined in accordance with item i.

(a) **Calculation of ~~Actual~~ Adjusted Indoor Lighting Power.** The ~~actual~~adjusted indoor Lighting Power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions 1 through ~~3~~ 4 of this subsection and the requirements of Subdivision 4 of this subsection.

**EXCEPTION to Section 140.6(a):** Up to 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.

1. **Two interlocked lighting systems.** No more than two lighting systems may be used for an area, and if there are two they must be interlocked. Where there are two interlocked lighting systems, the watts of the lower wattage system may be excluded from the ~~actual~~Adjusted ~~indoor~~ Indoor Lighting Power if:

   A. An Installation Certificate detailing compliance with Section 140.6(a)1 is submitted in accordance with Sections 10-103 and Section 130.4; and

   B. The area or areas served by the interlocking systems is an auditorium, a convention center, a conference room, a multipurpose room, or a theater; and

   C. The two lighting systems are interlocked with a Nonprogrammable Double-Throw Switch to prevent simultaneous operation of both systems.

   For compliance with Part 6 a Nonprogrammable Double-Throw Switch is an electrical switch commonly called a “single pole double throw” or “three-way” switch that is wired as

a selector switch allowing one of two loads to be enabled. It can be a line voltage switch or a low voltage switch selecting between two relays. It cannot be overridden or changed in any manner that would permit both loads to operate simultaneously.

**CHANGE SIGNIFICANCE:** Section 140.6(a)1 – The purpose of the change to this section and its subsections is to rename the lighting power from "Actual Indoor Lighting Power" to "Adjusted Indoor Lighting Power" to clarify that proposed indoor lighting power can be reduced when utilizing power adjustment factors and the tailored method lighting mounting height adjustment factor. This ensures appropriate distinction between Section 130.0, which determines the lighting power represented by the proposed equipment, and Section 140.6 which applies further adjustments to this value. This change is necessary to improve clarity and consistency of the Energy Code.

# 140.6(a)2

## Calculation of Adjusted Indoor Lighting Power, Reduction of Wattage Through Controls

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** New power adjustment factors for incorporating advanced daylighting measures into building envelope design were added.

**2019 CODE:**

(a) **Calculation of ~~Actual~~ Adjusted Indoor Lighting Power.** The ~~actual~~adjusted indoor Lighting Power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions 1 through ~~3~~ 4 of this subsection and the requirements of Subdivision 4 of this subsection.

[…]

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

[…]

L. To qualify for the PAFs for clerestory fenestration, horizontal slats, or light shelves in TABLE 140.6-A, the daylighting design shall meet the requirements in Section 140.3(d). The PAFs shall only apply to lighting in a primary or secondary sidelit daylit zone where continuous dimming daylighting controls meeting the requirements of Section 130.1(d) are installed.

**CHANGE SIGNIFICANCE:** Section 140.6(a)2L was added to introduce new power adjustment factors for incorporating advanced daylighting measures into the building design. Clerestories, horizontal slats, and light shelves can increase the amount of natural daylighting in a space. Pairing these advanced daylighting features with daylight harvesting controls can reduce energy consumption by automatically reducing electric lighting power when natural daylight is available.

# 140.6(a)3

## Calculation of Adjusted Indoor Lighting Power, Lighting Wattage Excluded

**CHANGE TYPE:** Clarification, Addition, and Modification

**CHANGE SUMMARY:** Clarification and addition of healthcare facilities to areas that do not need to include lighting wattage for compliance purposes.

**2019 CODE:**

(a) **Calculation of ~~Actual~~ Adjusted Indoor Lighting Power.** The ~~actual~~adjusted indoor Lighting Power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions 1 through ~~3~~ 4 of this subsection and the requirements of Subdivision 4 of this subsection.

[…]

3. **Lighting wattage excluded.** The watts of the following indoor lighting applications may be excluded from ~~actual indoor~~Adjusted Indoor Lighting Power ~~Density~~. (Indoor lighting not listed below shall comply with all applicable nonresidential indoor lighting requirements in Part 6.):

   […]

   E. Lighting installed by the manufacturer in walk-in coolers or freezers, vending machines, food preparation equipment, and scientific and industrial equipment.

   F. In office buildings with medical and clinical areas and healthcare facilities ~~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;

[…]

V. Lighting connected to a Life Safety Branch or Critical Branch, as specified in Section 517 of the *California Electrical Code*.

**CHANGE SIGNIFICANCE:** Section 140.6(a)3 – The purpose of the change to the section is to delete "density" from the phrase, "actual indoor lighting power density." Lighting power density refers to watts per square foot and it is used incorrectly in this section to describe lighting power which has the unit of watts. This change is necessary to improve clarity and consistency of the Energy Code.

Section 140.6(a)3E – The purpose of the change to the section is to add "coolers" as part of the phrase "walk-in coolers or freezers," as there are walk-in coolers in addition to walk-in freezers. This change is necessary to maintain consistency between the Energy Code and the Appliance Efficiency Regulations.

Section 140.6(a)3F – The purpose of the change to the section is to modify the existing term "medical and clinical buildings," to "office buildings with medical and clinical areas and healthcare facilities." This change was made to better align with the inclusion of healthcare facilities

as covered occupancies under the 2019 Energy Code and exempt them where necessary.

Section 140.6(a)3V – The purpose of the change to this section is to add a subsection for the lighting connected to life safety power or critical branch power in healthcare facilities. This change was made to better align with the inclusion of healthcare facilities as covered occupancies under the 2019 Energy Code and exempt them where necessary.

Getty Images

Walk-in Freezer – Lighting in walk-in freezers and coolers may be excluded from lighting power calculations.

# 140.6(a)4

## Calculation of Adjusted Indoor Lighting Power, Luminaire Classification and Power Adjustment

**CHANGE TYPE:** Clarification, Addition, and Modification

**CHANGE SUMMARY:** Power adjustment factors were added for small aperture tunable white and dim-to-warm LED luminaires, and a new subsection to address mounting height adjustments for wall and floor display lighting was added.

**2019 CODE:**

(a) **Calculation of ~~Actual~~ Adjusted Indoor Lighting Power.** The ~~actual~~adjusted indoor Lighting Power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions 1 through ~~3~~ 4 of this subsection and the requirements of Subdivision 4 of this subsection.

[…]

4. **Luminaire Classification and Power Adjustment.**

A. Luminaire Classification and Power shall be determined in accordance with Section 130.0(c).

B. Small Aperture Tunable-White and Dim-to-Warm Luminaires Lighting Power Adjustment. For qualifying small aperture tunable-white and dim-to-warm LED luminaires, the adjusted indoor lighting power of these luminaires shall be calculated by multiplying their maximum rated wattage by 0.75. Qualifying luminaires shall meet all of the following:

i. Small Aperture. Qualifying luminaires longer than 18 inches shall be no wider than four inches. Qualifying luminaires with a length of 18 inches or less shall be no wider than eight inches.

ii. Color Changing. Qualifying tunable-white luminaires shall be capable of a color change greater than or equal to 2,000 Kelvin correlated color temperature (CCT). Qualifying dim-to-warm luminaires shall be capable of color change greater than or equal to 500 Kelvin CCT.

iii. Controls. Qualifying luminaires shall be connected to controls that allows color changing of the luminaires.

C. Tailored Method Display Lighting Mounting Height Lighting Power Adjustment. For wall display luminaires or floor display luminaires meeting Tailored Method Section 140.6(c)3G and H and where the bottom of luminaires are 10 feet 7 inches and greater above the finished floor, the adjusted indoor lighting power of these luminaires shall be calculated by multiplying their maximum rated wattage and the appropriated mounting height adjustment factor from TABLE 140.6-E. Luminaire mounting height is the distance from the finished floor to the bottom of the luminaire. General lighting shall not qualify for a mounting height multiplier.

[…]

**TABLE 140.6-E Tailored ~~Adjustments For~~Wall and Floor Display Mounting Height ~~Above Floor~~ Adjustment Factors~~Factors~~**

| Height in feet above finished floor and bottom of luminaire(s) | Floor Display or Wall Display – ~~Multiply by~~Mounting Height Adjustment Factor |
|---|---|
| < ~~12'~~10'-7" | 1.00 |
| ~~12'~~ 10'-7" to ~~16'~~14'-0" | ~~0.87~~0.85 |
| >14'-0" to 18'-0" | 0.75 |
| > ~~16'~~18'-0" | ~~0.77~~0.70 |

**CHANGE SIGNIFICANCE:** Section 140.6(a)4 – The purpose of the change to this section is to add "Adjustment" to the heading to better differentiate it from a similar heading in Section 130.0(c), and make it clear that this section provides a further adjustment to the luminaire power determined in that section. This change clarifies without materially altering the requirements of the Energy Code.

Section 140.6(a)4A – The purpose of the change to this section is to number the subsections. The change clarifies without materially altering the requirements.

Section 140.6(a)4B – The purpose of the change to this section is to add a new subsection for additional lighting power allowed for qualifying small aperture tunable-white and dim-to-warm luminaires. This additional lighting power enables the use of qualifying small aperture tunable-white and dim-to-warm luminaires as the efficacy of these technologies is usually lower than that of LED luminaires with fixed correlated color temperature at this time. This change is necessary to improve clarity and consistency of the Energy Code.

Section 140.6(a)4C – The purpose of the change to this section is to add a new subsection for tailored method wall display lighting and floor display lighting adjustment factors. This section addresses mounting height adjustments to lighting power for wall display lighting and floor display lighting where the bottom of the luminaire is mounted greater than 10 feet, 6 inches above the finished floor. This subsection corresponds to the lighting power allowance requirements in Section 140.6(c)3G and H.

# 140.6(c)2

## Calculation of Allowed Indoor Lighting Power – Specific Methodologies, Area Category Method

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** Language was updated to account for a redesign of Table 140.6-C.

**2019 CODE:**

(c) **Calculation of Allowed Indoor Lighting Power: Specific Methodologies.** The allowed indoor Lighting Power for each building type, or each primary function area shall be calculated using only one of the methods in Subsection 1, 2 or 3 below as applicable.

[…]

2. **Area Category Method.** Requirements for using the Area Category Method include all of the following:

   A. The Area Category Method shall be used only for primary function areas, as defined in Section 100.1, that are listed in TABLE 140.6-C. For primary function areas not listed, selection of a reasonably equivalent type shall be permitted.

   […]

E. If at the time of permitting for a newly constructed building, a tenant is not identified for a multitenant area, a maximum of 0.4~~0.6~~ watts per square foot shall be allowed for the lighting in each area in which a tenant has not been identified. The area shall be classified as unleased tenant area.

F. Under the Area Category Method, the allowed indoor Lighting-Power for each primary function area is the Lighting Power Density value in TABLE 140.6-C times the square feet of the primary function area. The total allowed indoor ~~L~~ lighting ~~P~~ power density for the building is the sum of all allowed indoor lighting power densities for all areas in the building.

G. In addition to the allowed indoor ~~L~~ lighting ~~P~~ power calculated according to Sections 140.6(c)2~~.~~ A through F, the building may add additional lighting power allowances for qualifying lighting systems as specified in the Qualifying Lighting Systems column ~~specialized task work, ornamental, precision, accent, display, decorative, and white boards and chalk boards, in accordance with the footnotes~~ in TABLE 140.6-C under the following conditions:

   i. Only primary function areas having a lighting system as specified in the Qualifying Lighting Systems column ~~footnote next to the allowed Lighting Power Density allotments~~ in TABLE 140.6-C and in accordance with the corresponding footnote of the TABLE shall qualify for the ~~added~~ additional lighting power allowances ~~in accordance with the correlated footnote listed at the bottom of the table~~; and

   ii. The additional lighting power allowances shall be used only if the plans clearly identify all applicable task areas and the lighting equipment designed to illuminate these tasks; and

iii. Tasks that are performed less than two hours per day or poor quality tasks that can be improved are not eligible for the additional lighting power allowances; and

iv. The additional lighting power allowances shall not utilize any type of luminaires that are used for general lighting in the building; and

v. The additional lighting power allowances shall not be used when using the Complete Building Method, or when the Tailored Method is used for any area in the building; and

vi. The additional lighting power allowed is the smaller of:

a. The lighting power density listed in the "Allowed Additional Lighting LPD" column ~~applicable footnote~~ in TABLE 140.6-C, times the square feet of the primary function, or

b. The ~~actual~~ Adjusted Indoor Lighting Power of ~~design wattage may be added to~~ the ~~allowed~~ applicable lighting ~~power~~; and

vii. In addition to all other additional lighting power allowed under Sections 140.6(c)2Gi through vi, up to ~~1.5~~1.0 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 is prepared and submitted in accordance with Section 130.4(b), specifically detailing compliance with the applicable requirements of Section 140.6(c)2Gvii; and

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; and

c. General lighting is switched in accordance with TABLE 130.1-A; and

d. Wall wash lighting is separately switched from the general lighting system; and

e. All of the lighting in the studio, including general lighting and additional lighting power allowed by Section 140.6(c)2Gvii is controlled by a multiscene programmable control system (also known as a scene preset control system).

[…]

**TABLE 140.6-C Area Category Method-Lighting Power Density Values (Watts/ft²)**

| Primary Function Area | | Allowed Lighting Power Density for General Lighting (W/ft²) | Additional Lighting Power[1] | |
|---|---|---|---|---|
| | | | Qualified Lighting Systems | Additional Allowance (W/ft², unless noted otherwise) |
| Auditorium Area | | 0.70 | Ornamental | 0.30 |
| | | | Accent, display and feature[3] | 0.20 |
| Auto Repair / Maintenance Area | | 0.55 | Detailed Task Work[7] | 0.20 |
| Audience Seating Area | | 0.60 | Ornamental | 0.30 |
| Beauty Salon Area | | 0.80 | Detailed Task Work[7] | 0.20 |
| | | | Ornamental | 0.30 |
| Civic Meeting Place Area | | 1.00 | Ornamental | 0.30 |
| Classroom, Lecture, Training, Vocational Area | | 0.70 | White or Chalk Board[1] | 4.50 W/ft |
| Commercial/Industrial Storage | Warehouse | 0.45 | - | - |
| | Shipping & Handling | 0.60 | - | - |
| Convention, Conference, Multipurpose and Meeting Area | | 0.85 | Ornamental | 0.30 |
| Copy Room | | 0.50 | - | - |
| Corridor Area | | 0.60 | - | - |
| Dining Area | Bar/Lounge and Fine Dining | 0.55 | Ornamental | 0.30 |
| | Cafeteria/Fast Food | 0.40 | | |
| | Family and Leisure | 0.50 | | |
| Electrical, Mechanical, Telephone Rooms | | 0.40 | Detailed Task Work[7] | 0.20 |
| Exercise/Fitness Center and Gymnasium Area | | 0.50 | - | - |
| Hotel Function Area | | 0.85 | Ornamental | 0.30 |
| Museum Area | Exhibition/ Display | 0.60 | Accent, display and feature[3] | 0.50 |
| | Restoration Room | 0.75 | Detailed Task Work[7] | 0.20 |
| Financial Transaction Area | | 0.80 | Ornamental | 0.30 |
| General/Commercial & Industrial Work Area | Low Bay | 0.60 | Detailed Task Work[7] | 0.20 |
| | High Bay | 0.65 | Detailed Task Work[7] | 0.20 |
| | Precision | 0.85 | Precision Specialized Work[9] | 0.70 |

**TABLE 140.6-C Area Category Method-Lighting Power Density Values (Watts/ft²)**

| Primary Function Area | | Allowed Lighting Power Density for General Lighting (W/ft²) | Additional Lighting Power[1] | |
|---|---|---|---|---|
| | | | Qualified Lighting Systems | Additional Allowance (W/ft², unless noted otherwise) |
| Library | Reading Area | 0.80 | Ornamental | 0.30 |
| | Stacks Area | 1.10 | | |
| Main Entry Lobby | | 0.85 | Ornamental | 0.30 |
| Locker Room | | 0.45 | - | - |
| Lounge, Breakroom, or Waiting Area | | 0.65 | Ornamental | 0.30 |
| Concourse and Atria Area | | 0.90 | Ornamental | 0.30 |
| Office Area | > 250 square feet | 0.65 | Portable lighting for office areas[6] | 0.20 |
| | ≤ 250 square feet | 0.70 | | |
| | Open plan office | 0.60 | | |
| Parking Garage Area | Parking Zone | 0.10 | First ATM | 100 W |
| | | | Additional ATM | 50 W each |
| | Dedicated Ramps | 0.25 | - | - |
| | Daylight Adaptation Zones[2] | 0.50 | - | - |
| Pharmacy Area | | 1.10 | Specialized Task Work[8] | 0.35 |
| Retail Sales Area | Grocery Sales | 1.05 | Accent, display and feature[3] | 0.20 |
| | | | Decorative | 0.15 |
| | Retail Merchandise Sales | 1.00 | Accent, display and feature[3] | 0.20 |
| | | | Decorative | 0.15 |
| | Fitting Room | 0.60 | External Illuminated Mirror[5] | 40 W/ea |
| | | | Internal Illuminated Mirror[5] | 120 W/ea |
| Theater Area | Motion picture | 0.60 | Ornamental | 0.30 |
| | Performance | 1.00 | | |
| Kitchen/Food Preparation Area | | 0.95 | - | - |
| Scientific Laboratory Area | | 1.00 | Specialized Task Work[8] | 0.35 |

**TABLE 140.6-C Area Category Method-Lighting Power Density Values (Watts/ft²)**

| Primary Function Area | | Allowed Lighting Power Density for General Lighting (W/ft²) | Additional Lighting Power[1] | |
|---|---|---|---|---|
| | | | Qualified Lighting Systems | Additional Allowance (W/ft², unless noted otherwise) |
| Healthcare Facility and Hospitals | Exam/Treatment Room | 1.15 | - | - |
| | Imaging Room | 1.00 | - | - |
| | Medical Supply Room | 0.55 | - | - |
| | Nursery | 0.95 | Tunable white or dim-to-warm[10] | 0.10 |
| | Nurse's Station | 0.75 | Tunable white or dim-to-warm[10] | 0.10 |
| | Operating Room | 1.90 | - | - |
| | | | Decorative | 0.15 |
| | Patient Room | 0.55 | Tunable white or dim-to-warm[10] | 0.10 |
| | Physical Therapy Room | 0.85 | Tunable white or dim-to-warm[10] | 0.10 |
| | Recovery Room | 0.90 | Tunable white or dim-to-warm[10] | 0.10 |
| Laundry Area | | 0.45 | - | - |
| Religious Worship Area | | 0.95 | Ornamental | 0.30 |
| Restrooms | | 0.65 | Accent, display and feature[3] | 0.20 |
| | | | Decorative[4] | 0.15 |
| Transportation Function | Baggage Area | 0.40 | - | - |
| | Ticketing Area | 0.45 | Accent, display and feature[3] | 0.20 |
| Sports Arena – Playing Area | Class I Facility[13] | 2.25 | - | - |
| | Class II Facility[13] | 1.45 | - | - |
| | Class III Facility[13] | 1.10 | - | - |
| | Class IV Facility[13] | 0.75 | - | - |
| Stairwell | | 0.50 | Accent, display and feature[3] | 0.20 |
| | | | Decorative[4] | 0.15 |
| Videoconferencing Studio | | 0.90 | Videoconferencing | 1.00 |

**TABLE 140.6-C Area Category Method-Lighting Power Density Values (Watts/ft²)**

| Primary Function Area | | Allowed Lighting Power Density for General Lighting (W/ft²) | Additional Lighting Power[1] | |
|---|---|---|---|---|
| | | | Qualified Lighting Systems | Additional Allowance (W/ft², unless noted otherwise) |
| All other | | 0.40 | - | - |
| Aging Eye/Low-vision[11] | Main Entry Lobby | 0.85 | Ornamental | 0.30 |
| | | | Transition Lighting OFF at night[12] | 0.95 |
| | Stairwell | 0.80 | - | - |
| | Corridor Area | 0.80 | Decorative[4] | 0.15 |
| | Lounge/Waiting Area | 0.75 | Ornamental | 0.30 |
| | Multipurpose Room | 0.95 | Ornamental | 0.30 |
| | Religious Worship Area | 1.00 | Ornamental | 0.30 |
| | Dining | 0.80 | Ornamental | 0.30 |
| | Restroom | 0.80 | Accent, display and feature[3] | 0.20 |

Footnotes for this table are listed below.

1. White board or chalk board. – Directional lighting dedicated to a white board or chalk board.
2. Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage.
3. Accent, display and feature lighting – luminaires shall be adjustable or directional.
4. Decorative lighting – primary function shall be decorative and not to provide general lighting.
5. Illuminated mirrors. Lighting shall be dedicated to the mirror.
6. Portable lighting in office areas includes under shelf or furniture-mounted supplemental task lighting qualifies when controlled by a time clock or an occupancy sensor.
7. Detailed task work – Lighting provides high level of visual acuity required for activities with close attention to small elements and/or extreme close up work.
8. Specialized task work – Lighting provides for small-scale, cognitive or fast performance visual tasks; lighting required for operating specialized equipment associated with pharmaceutical/laboratorial activities.
9. Precision specialized work – Lighting for work performed within a commercial or industrial environment that entails working with low contrast, finely detailed, or fast moving objects.
10. Tunable white luminaires capable of color change greater than or equal to 2000K CCT, or dim-to-warm luminaires capable of color change greater than or equal to 500K CCT, connected to controls that allows color changing of the luminaires.
11. Aging Eye/Low-vision areas can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and are or will be licensed by local or state authorities for either senior long-term care, adult day care, senior support, and/or people with special visual needs.
12. Transition lighting OFF at night. Lighting power controlled by astronomical time clock or other control to shut off lighting at night. Additional LPD only applies to area within 30 feet of an exit. Not applicable to lighting in daylit zones.
13. Class I Facility is used for competition play for 5000 or more spectators. Class II Facility is used for competition play for up to 5000 spectators. Class III Facility is used for competition play for up to 2000 spectators. Class IV Facility is normally used for recreational play and there is limited or no provision for spectators.

**TABLE 140.6-C Area Category Method-Lighting Power Density Values (Watts/ft²)**

| Primary Function Area | | Allowed Lighting Power Density (W/ft²) | Primary Function Area | | Allowed Lighting Power Density (W/ft²) |
|---|---|---|---|---|---|
| Auditorium Area | | 1.403 | Library Area | Reading areas | 1.13 |
| Auto Repair Area | | 0.902 | | Stack areas | 1.53 |
| Beauty Salon Area | | 1.7 | Lobby Area | Hotel lobby | 0.953 |
| Civic Meeting Place Area | | 1.33 | | Main entry lobby | 0.953 |
| Classroom, Lecture, Training, Vocational Areas | | 1.25 | Locker/Dressing Room | | 0.70 |
| Commercial and Industrial Storage Areas (conditioned and unconditioned) | | 0.60 | Lounge Area | | 0.903 |
| Commercial and Industrial Storage Areas (refrigerated) | | 0.7 | Malls and Atria | | 0.953 |
| Convention, Conference, Multipurpose and Meeting Center Areas | | 1.23 | Medical and Clinical Care Area | | 1.2 |
| Corridor, Restroom, Stair, and Support Areas | | 0.60 | Office Area | > 250 square feet | 0.75 |
| Dining Area | | 1.03 | | ≤ 250 square feet | 1.0 |
| Electrical, Mechanical, Telephone Rooms | | 0.552 | Parking Garage Area | Parking Area 10 | 0.14 |
| Exercise Center, Gymnasium Areas | | 1.0 | | Dedicated Ramps | 0.30 |
| Exhibit, Museum Areas | | 1.8 | | Daylight Adaptation Zones 9 | 0.60 |
| Financial Transaction Area | | 1.03 | Religious Worship Area | | 1.53 |
| General Commercial and Industrial Work Areas | Low bay | 0.92 | Retail Merchandise Sales, Wholesale Showroom Areas | | 1.26 and 7 |
| | High bay | 1.02 | | | |
| | Precision | 1.24 | Theater Area | Motion picture | 0.903 |
| Grocery Sales Area | | 1.26 and 7 | | Performance | 1.43 |
| Hotel Function Area | | 1.43 | Transportation Function Area | Concourse & Baggage | 0.50 |
| | | | | Ticketing | 1.0 |
| Kitchen, Food Preparation Areas | | 1.2 | Videoconferencing Studio | | 1.28 |
| Laboratory Area, Scientific | | 1.41 | Waiting Area | | 0.803 |
| Laundry Area | | 0.70 | All other areas | | 0.50 |

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.

**TABLE 140.6-C Area Category Method-Lighting Power Density Values (Watts/ft²)**

| Footnote number | Type of lighting system allowed | Allowed lighting power density. (W/ft² of task area unless otherwise noted) |
|---|---|---|
| 1 | Specialized task work | 0.20 W/ft² |
| 2 | Specialized task work | 0.50 W/ft² |
| 3 | Ornamental lighting as defined in Section 100.1 and in accordance with Section 140.6.(c)2. | 0.50 W/ft² |
| 4 | Precision commercial and industrial work | 1.0 W/ft² |
| 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 | 0.30 W/ft² |
| 7 | Decorative lighting - primary function shall be decorative and shall be in addition to general illumination. | 0.20 W/ft² |
| 8 | Additional Videoconferencing Studio lighting complying with all of the requirements in Section 140.6(c)2Gvii. | 1.5 W/ft² |
| 9 | Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage | |
| 10 | Additional allowance for ATM locations in Parking Garages. Allowance per ATM. | 200 watts for first ATM location. 50 watt for each additional ATM location in a group. |

**CHANGE SIGNIFICANCE:** Section 140.6(c)2A – The purpose of the change to this section is to add a new provision that allows selection of a reasonably equivalent function area type for areas not defined in Table 140.6-C. This change aligns with a similar requirement of ASHRAE 90.1-2016. Federal law (Title 42 of the United States Code, Section 6316(b((2)) grants State and local governments the ability to adopt ASHRAE 90.1-2016 efficiency requirements into the local building codes, given that the building codes do not exceed the minimum energy efficiency requirements of ASHRAE 90.1-2016, and the building codes do not take effect prior to the effective date of the applicable minimum energy efficiency requirements of ASHRAE 90.1-2016. This change is necessary to maintain alignment with ASHRAE 90.1-2016, consistent with the above stated law.

Section 140.6(c)2E – The purpose of the change to this section is to update the lighting power allowance for unleased tenant spaces in multi-tenant areas to 0.4 watts per square foot. This change corresponds to the update of the lighting power allowance in Table 140.6-C. The change clarifies the Energy Code and is necessary to improve clarity and consistency.

Section 140.6(c)2F – The purpose of the change to this section is to change language to "each primary function area," in order to use consistent language in referring to primary function areas. The change clarifies the Energy Code and is necessary to improve clarity and consistency.

Section 140.6(c )2G – The purpose of the change to this section and the subsections is to clarify that the additional "use-it-or-lose" lighting power allowances for qualifying lighting applications are tabulated in a new column within Table 140.6-C. The additional allowances are no longer listed as footnotes to the table. The change clarifies the Energy Code and is necessary to improve clarity and consistency.

Section 140.6(c)2Gvi – The purpose of the change to this section is to modify the subsection as the lighting power information is in the Qualifying Lighting System column of Table 140.6-C, in lieu of the footnotes. The change clarifies the Energy Code and is necessary to improve clarity and consistency.

Section 140.6(c)2Gvii – The purpose of the change to the section is to update the additional lighting power allowance for video conferencing studio lighting to 1.0 watts per square foot. This change corresponds to the update of the lighting power allowance for videoconferencing studio lighting in Table 140.6-C. The change clarifies the Energy Code and is necessary to improve clarity and consistency.

# 140.6(c)3

## Calculation of Allowed Indoor Lighting Power: Specific Methodologies Tailored Method

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** Language was altered to clarify and simplify the requirements for to calculating general lighting power allowance and additional lighting power allowances with the tailored method.

**2019 CODE:**

(c) **Calculation of Allowed Indoor Lighting Power: Specific Methodologies.** The allowed indoor Lighting Power for each building type, or each primary function area shall be calculated using only one of the methods in Subsection 1, 2 or 3 below as applicable.

[…]

3. **Tailored Method.** Requirements for using the Tailored Method include all of the following:

   A. 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. Allowed Indoor Lighting Power allotments for general lighting shall be determined according to Section 140.6(c)3~~G or H~~F, as applicable. ~~General lighting shall not qualify for a mounting height multiplier.~~

   C. For compliance with ~~this Item~~Section 140.6(c)3, an "area" shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in TABLE 140.6-D.

   […]

   E. In addition to the allowed indoor ~~L~~lighting ~~P~~power allotments for general lighting calculated according to Sections 140.6(c)3~~G or H~~F, as applicable, the building may add additional lighting power allowances for wall display lighting, floor display lighting and task lighting, ornamental/special effects lighting, and very valuable display cases lighting according to Sections 140.6(c)~~3I~~ 3G through ~~L~~J.

   ~~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.~~

   ~~G~~F. Determine allowed indoor ~~L~~lighting ~~P~~power allotments for general lighting for primary function areas listed in TABLE 140.6-D as follows:

      i. Use the General ~~IES Illuminance~~Illumination ~~values~~ Level (Lux) listed in Column 2 of Table 140.6-D to determine the Allowed General Lighting Power Density allotments for the area.

      ii. Determine the room cavity ratio (RCR) for the area. The RCR shall be calculated according to the applicable equation in TABLE 140.6-F.

iii. Find the allowed General Lighting Power Density allotments in TABLE 140.6-G that is applicable to the ~~IES~~ General I~~i~~lluminance ~~value~~ Level (Lux) from Column 2 of Table 140.6-D (as described in Item i.) and the RCR determined in accordance with TABLE 140.6-F (as described in Item ii).

iv. Determine the square feet of the area in accordance with Section 140.6(c)3C and D.

v. Multiply the allowed Lighting Power Density allotment, as determined in accordance with Item iii by the square feet of each primary function area, as determined in accordance with Item iv. The product is the ~~A~~allowed ~~I~~indoor ~~L~~lighting ~~P~~power allotment for general lighting for the area.

~~H. Determine allowed indoor Lighting Power allotments for general lighting for only specific primary function areas NOT listed in TABLE 140.6-D as follows:~~

~~i. Use this Section only to calculate allowed indoor lighting power for general lighting in the following primary function areas. Do not use Section 140.6(c)3H for any primary function areas NOT listed below:~~

~~a. Exercise Center, Gymnasium~~

~~b. Medical and Clinical Care~~

~~c. Police Stations and Fire Stations~~

~~d. Public rest areas along state and federal roadways~~

~~e. Other primary function areas that are listed in neither TABLE 140.6-C nor TABLE140.6-D.~~

~~ii. When calculating allowed indoor Lighting Power allotments for general lighting using Section 140.6(c)3H, the building shall not add additional lighting power allowances for any other use, including but not limited to wall display, floor display and task, ornamental/special effects, and very valuable display case lighting.~~

~~iii. Calculate the allowed indoor Lighting Power for each primary function area in the building as follows:~~

~~a. Determine the illuminance values (Lux) according to the Tenth Edition IES Lighting Handbook (IES HB), using the Recommended Horizontal Maintained Illuminance Targets for Observers 25-65 years old for illuminance.~~

~~b. Determine the room cavity ratio (RCR) for area. The RCR shall be calculated according to the applicable equation in TABLE 140.6-F.~~

~~c. Find the allowed lighting power density in TABLE 140.6-G that is applicable to the illuminance value (Lux) determined in accordance with Item (a) and the RCR determined in accordance with Item (b).~~

~~d. Determine the square feet of the area. For compliance with this item, an "area" shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in Item (i). Where areas are bounded or separated by interior partitions, the floor area occupied by those interior partitions may be included in a Primary Function Area.~~

~~e. Multiply the square feet determined in accordance with Item (d), by the allowed lighting power density determined in accordance with item (c). The product is the Allowed Indoor Lighting Power allotment for general lighting for the area.~~

~~H~~G. Determine additional allowed power for wall display lighting according to column 3 of Table 140.6-D for each primary function area as follows:

~~i. Additional wall display lighting power shall not be available when using Section 140.6(c)3H for determining the Allowed Indoor Lighting Power allotment for general lighting for the area.~~

~~ii~~i. Floor displays shall not qualify for wall display allowances.

~~iiii~~i. Qualifying wall lighting shall:

a. Be mounted within 10 feet of the wall having the wall display. When track lighting is used for wall display, and where portions of that lighting track are more than 10 feet from the wall and other portions are within 10 feet of the wall, portions of track more 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. Lighting systems appropriate for wall lighting are lighting track adjacent to the wall, wall-washer luminaires, luminaires behind a wall valance or wall cove, or accent light. (Accent luminaires are adjustable or fixed luminaires with PAR, R, MR, AR, or ~~other directional lamp types~~luminaires providing directional display light).

~~iv~~iii. Additional allowed power for wall display lighting is available only for lighting that illuminates walls having wall displays. The length of display walls shall include the length of the perimeter walls, including but not limited to closable openings and permanent full height interior partitions. Permanent full height interior partitions are those that (I) extend from the floor to ~~no more than~~ within 2 feet of the ceiling or are taller than 10 feet~~,~~ and (II) are permanently anchored to the floor~~, provided, however, that neither commercial industrial stacks nor industrial storage stacks are permanent full height interior partitions~~.

~~v~~iv. ~~The wall display mounting height multiplier is the applicable factor from TABLE 140.6-E. Mounting height is the distance from the finished floor to the bottom of the luminaire. The wall display mounting height multipliers shall be used to reduce the design watts of the space.~~ For wall display lighting where the bottom of the luminaire is greater than 10 feet 6 inches above the finished floor, the mounting height adjustment factor from TABLE 140.6-E can be used to adjust the installed luminaire wattage as specified in Section 140.6(a)4C.

~~v~~iv. The ~~additional~~ allowed power for wall display lighting shall be the smaller of:

a. ~~The~~ The "~~product of~~ wall display lighting power density" determined in accordance with TABLE 140.6-D, ~~times~~ multiplied by the wall display lengths determined in accordance with Item ~~iv~~iii; ~~or~~ and

b. The ~~actual~~ Adjusted Indoor Lighting P~~p~~ower used for the wall display lighting systems.

vi. Lighting internal to display cases that are attached to a wall or directly adjacent to a wall are counted as wall display lighting as specified in Section 140.6(c)3G. All other lighting internal to display cases are counted as floor display lighting as specified in Section 140.6(c)3H, or as very valuable display case lighting as specified in Section 140.6(c)3J.

~~J~~H. Determine additional allowed power for floor display lighting and task lighting as follows:

~~i. Neither additional allowed power for floor display lighting nor additional allowed power for task lighting shall be available when using Section 140.6(c)3H for determining allowed indoor Lighting Power allotment for general lighting.~~

~~ii~~i. Displays that are installed against a wall shall not qualify for the floor display lighting power allowances.

~~iii~~ii. Lighting internal to display cases that are not attached to a wall and not directly adjacent to a wall, shall be counted as floor display lighting in accordance with Section 140.6(c)~~3J~~3H; or very valuable display case lighting in accordance with Section 140.6(c)3~~Liii and iv~~J.

~~iv~~iii. Additional allowed power for floor display lighting, and additional allowed power for task lighting, may be used by qualifying floor display lighting systems, qualifying task lighting systems, or a combination of both. For floor areas qualifying for both floor display and task lighting power allowances, the additional allowed power shall be used only once for the same floor area, so that the allowance shall not be additive.

~~v~~iv. Qualifying floor display lighting shall:

a. Be mounted no closer than 2 feet to a wall.

b. Consist of only (I) directional ~~lighting~~ lamp types, such as PAR, R, MR, AR; or (II) ~~lighting employing optics~~luminaires providing directional display light ~~from nondirectional lamps~~.

c. If track lighting is used, shall be only track heads that are classified as direction lighting types.

~~vi~~v. Qualifying task lighting 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~~vi. If there are illuminated floor displays, floor display lighting power shall be used only if allowed by Column 4 of TABLE 140.6-D.

viii. ~~Additional allowed power for a combination of floor display lighting and task lighting shall be available only for (I) floors having floor displays; or (II) floors not having floor displays but having tasks having illuminance recommendations that appear in the Tenth Edition of the IES Lighting Handbook and that are higher than the general lighting level in column 2 of TABLE 140.6-D.~~ The square footage of floor displays or the square footage of task areas shall be determined in accordance with Section 140.6(c)3C and D, except that any floor area designed to not have floor displays or tasks, such as floor areas designated as a path of egress, shall not be included for the floor display allowance.

~~ix~~viii. For floor display lighting where the bottom of the luminaire is greater than 10.6 feet above the finished floor, multiply the floor display installed watts by the appropriate mounting height adjustment factor from Table 140.6-E to calculate the Adjusted Indoor Lighting Power as specified in Section 140.6(a)4C. ~~For floor display lighting where the bottom of the luminaire is 12 feet or higher above the finished floor, the wattage allowed in column 4 of TABLE 140.6-D may be increased by multiplying the floor display lighting power allowance by the appropriate factor from TABLE 140.6-E Luminaire mounting height is the distance from the finished floor to the bottom of the luminaire.The floor display mounting height multipliers shall be used to reduce the design watts of the space.~~

ix. The ~~additional~~ allowed power for floor display lighting for each applicable area shall be the smaller of:

a. ~~The~~ the ~~product of~~ allowed floor display and task lighting power determined in accordance with Section 140.6(c)~~3Jvii~~ 3Hvi ~~times~~ multiplied by the floor square footage determined in accordance with Section 140.6(c)~~3J~~3Hvii~~viii~~; and ~~or~~

b. The ~~actual power~~Adjusted Indoor Lighting Power used for the floor display lighting systems.

~~K~~I. Determine additional allowed power for ornamental/special effects lighting as follows:

~~i. Additional allowed power for ornamental/special effects lighting shall not be available when using Section 140.6(c)3H for determining general Lighting Power allowances.~~

~~ii~~i. Qualifying ornamental lighting includes luminaires such as chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights and light color panels, when any of those lights are used in a decorative manner that does not serve as display lighting or general lighting.

~~iii~~ii. Additional lighting power for ornamental/special effects lighting shall be used only if allowed by Column 5 of TABLE 140.6-D.

~~iv~~iii. Additional lighting power for ornamental/special effects lighting shall be used only in areas having ornamental/special effects lighting. The square footage of the floor area shall be determined in accordance with Section 140.6(c)3C and D, and it shall not include floor areas not having ornamental/special effects lighting.

~~v~~iv. The additional ~~additional~~ allowed power for ornamental/special effects lighting for each applicable area shall be the smaller of:

a. ~~The~~ The the product of the "allowed ornamental/special effects lighting power" determined in accordance with Section 140.6(c)~~3Kiii~~3Iii, ~~times~~ multiplied by the floor square footage determined in accordance with Section 140.6(c)~~3Kiv~~3Iiii; ~~or~~ and

b. ~~The actual power~~The Adjusted Indoor Lighting Power of allowed ornamental/special effects lighting.

~~L~~J. Determine additional allowed power for very valuable display case lighting as follows:

~~i. Additional allowed power for very valuable display case lighting shall not be available when using Section 140.6(c)3H for determining general Lighting Power allowances.~~

~~ii~~i. Additional allowed power for very valuable display case lighting shall be available only for display cases in appropriate function areas in retail merchandise sales, museum and religious worship.

~~iii~~ii. To qualify for additional allowed power for very valuable display case lighting, a case shall contain jewelry, coins, fine china, fine 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~~iii. 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~~iv. If there is qualifying very valuable display case lighting, in accordance with Section 140.6(c)~~3Liii~~3Jii, 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 ~~0.8~~0.55 watt per square foot; or

b. The product of the area of the display case and ~~12~~ 8 watts per square foot; or

c. The ~~actual~~ Adjusted Indoor Lighting ~~power~~ Power of lighting for very valuable displays.

**TABLE 140.6-D Tailored Method Lighting Power Allowances**

| 1<br>Primary Function Area | 2<br>General Illumination Level (Lux) | 3<br>Wall Display Lighting Power Density (W/ft) | 4<br>Allowed Combined Floor Display Power and Task Lighting Power Density (W/ft$^2$) | 5<br>Additional Ornamental/Special Effect Lighting Power Density (W/ft$^2$) |
|---|---|---|---|---|
| Auditorium area | 300 | ~~2.25~~3.00 | ~~0.3~~0.20 | ~~0.5~~0.40 |
| ~~Civic meeting place~~ | ~~300~~ | ~~3.15~~ | ~~0.2~~ | ~~0.5~~ |
| Convention, conference, multipurpose, and meeting center areas | 300 | ~~2.50~~2.00 | ~~0.4~~0.35 | ~~0.5~~0.40 |
| Dining areas | 200 | ~~1.50~~1.25 | ~~0.6~~0.50 | ~~0.5~~0.40 |
| Exhibit, museum areas | 150 | ~~15.0~~11.50 | ~~1.2~~0.80 | ~~0.5~~0.40 |
| ~~Financial transaction area~~ | 300 | ~~3.15~~ | ~~0.2~~ | ~~0.5~~ |
| ~~Grocery store area~~ | 500 | ~~8.00~~ | ~~0.9~~ | ~~0.5~~ |
| Hotel area: | | | | |
| ~~Hotel function Area~~Ballroom/Events | 400 | ~~2.25~~1.80 | ~~0.2~~0.12 | ~~0.5~~0.40 |
| ~~Lobby Area:~~ | | | | ~~0.5~~0.40 |
| ~~Hotel l~~Lobby | 200 | ~~3.15~~3.50 | 0.20 | ~~0.5~~0.40 |
| Main entry lobby | 200 | ~~0~~3.50 | 0.20 | ~~0~~0.40 |
| ~~Lounge area~~ | ~~200~~ | ~~7.00~~ | ~~0~~ | ~~0.5~~ |
| ~~Malls and Atria~~ | ~~300~~ | ~~3.50~~ | ~~0.5~~ | ~~0.5~~0.40 |
| Religious worship area | 300 | ~~1.50~~1.30 | ~~0.5~~0.40 | ~~0.5~~0.40 |
| Retail sales | | | | |
| Grocery | 600 | 6.80 | 0.70 | 0.40 |
| ~~Retail~~ merchandise sales, and showroom areas | ~~400~~500 | ~~14.00~~11.80 | ~~1.0~~0.80 | ~~0.5~~0.40 |
| Theater Area: | | | | |
| Motion picture | 200 | ~~3.00~~2.00 | ~~0~~0.20 | ~~0.5~~0.40 |
| Performance arts | 200 | ~~6.00~~7.50 | ~~0~~0.20 | ~~0.5~~0.40 |
| ~~Transportation function area~~ | ~~300~~ | ~~3.15~~ | ~~0.3~~ | ~~0.5~~ |
| ~~Waiting area~~ | ~~300~~ | ~~3.15~~ | ~~0.2~~ | ~~0.5~~ |

**TABLE 140.6-F Room Cavity Ratio (RCR) Equations**

| 1 |
|---|
| Determine the Room Cavity Ratio for Table 140.6-G using one of the following equations. |
| Room cavity ratio for rectangular rooms $$RCR = 5\frac{5 \times H \times (L + W)}{L + W}$$ |
| 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 140.6-G Tailored Method General Lighting Power Allowed — ~~Illuminance Level (LUX) Power Density Values (Watts/Ft²)~~By Illumance and Room Cavity Ratio**

| General Illuminance Level (lux)a | General Lighting Power Density (W/ft²) for the following RCR values[b] values[b] | | | |
|---|---|---|---|---|
| | RCR ≤ 2.0 | RCR > 2.0 and ≤ 3.5 | RCR > 3.5 and ≤ 7.0 | RCR > 7.0 |
| ~~50~~ | ~~0.18~~ | ~~0.22~~ | ~~0.32~~ | ~~0.46~~ |
| ~~100~~ | ~~0.30~~ | ~~0.38~~ | ~~0.56~~ | ~~0.84~~ |
| 150 | 0.40 | 0.45 | 0.60 | 00.75 |
| 200 | ~~0.48~~0.45 | ~~0.64~~0.55 | ~~0.88~~0.75 | ~~1.34~~1.00 |
| 300 | ~~0.64~~0.65 | ~~0.82~~0.80 | ~~1.12~~1.00 | ~~1.76~~1.40 |
| 400 | ~~0.78~~0.75 | ~~0.98~~0.95 | ~~1.34~~1.25 | ~~2.08~~1.50 |
| 500 | 0.90 | ~~1.10~~1.05 | ~~1.52~~1.45 | ~~2.32~~1.85 |
| 600 | 1.08 | 1.24 | 1.64 | 2.38 |
| a Illuminance values from Column 2 of Table 140.6-D. b RCR values are calculated using applicable equations in Table 140.6-F. | | | | |
| ~~600~~ | ~~1.06~~ | ~~1.26~~ | ~~1.74~~ | ~~2.60~~ |
| ~~700~~ | ~~1.24~~ | ~~1.46~~ | ~~1.82~~ | ~~2.96~~ |
| ~~800~~ | ~~1.44~~ | ~~1.70~~ | ~~2.28~~ | ~~3.30~~ |
| ~~900~~ | ~~1.66~~ | ~~2.00~~ | ~~2.64~~ | ~~3.74~~ |
| ~~1000~~ | ~~1.84~~ | ~~2.20~~ | ~~2.90~~ | ~~4.06~~ |

**CHANGE SIGNIFICANCE:** Section 140.6(c)3A – The purpose of the change to this subsection is to delete the primary function area reference to Illuminating Engineering Society (IES) allowance listed in Section 140.6(c)3H as the subsection specifying the IES references is removed from the Energy Code. The change clarifies the requirements of the Energy Code and is necessary to improve clarity and consistency.

Section 140.6(c)3B – The purpose of the changes to this section is to renumber the reference to subsection 140.6(c)3F due to changes to other subsections within Section 140.6(c).

Language which excluded general lighting from utilizing mounting height adjustment factors was also removed and relocated. This language has been relocated to Section 140.6(a)4C. This change is necessary to improve clarity and consistency.

Section 140.6(c)3E – The purpose of the change to this section is to add "lighting" to the section as appropriate. The change clarifies the Energy Code and is necessary to improve clarity and consistency.

Section 140.6(c)3F (existing) – The purpose of the changes to this section is to remove a restriction that is generally redundant with the definition of "general lighting," and that is unnecessarily technology specific. Although directional light sources are most commonly used for wall, floor, and display lighting, there are scenarios where directional light sources are used as general illumination sources. The change has the substantive effect of allowing the use of these technologies for providing general lighting and is necessary both to ensure that the provisions of the Energy Code are technology neutral and to avoid unnecessarily restricting approaches to the design of general lighting systems.

Section 140.6(c)3H (existing) – The purpose of the deletion of the existing Section 140.6(c)3H is to remove provisions for calculating general lighting power allowance for specific primary function areas not listed in Table 140.6-D. For primary function areas not listed in Table 140.6-D, a new provision that allows selection of a reasonably equivalent area type is specified in Section 140.6(c)2A, making this section redundant. The changes here clarify the Energy Code and is necessary to improve clarity and consistency.

Section 140.6(c)3F – The purpose of the change to the section and subsections is to modify the term from "IES Illumination values" to "General Illumination Level" to correspond to changes in Table 140.6-D. The change clarifies the Energy Code and is necessary to improve the code's clarity and consistency. Modifications were also made to existing language by adding "General" to the terms in the subsection, changing them to "General Lighting" and "General Illuminance Level." This change corresponds to changes in Table 140.6-D.

Section 140.6(c)3G – The purpose of the change to this section is to renumber the subsections, as there are subsections being deleted and new subsections added.

Section 140.6(c)3Gi – The purpose of the change to this section is to delete the subsection reference to Section 140.6(c)3H as the provisions in Section 140.6(c)3H have been removed.

Section 140.6(c)3Giib – The purpose of the change to this section is to clarify the types of lighting permitted, as accent luminaires can also be luminaires providing directional display light.

Section 140.6(c)3Giii – The purpose of the change to this section is to clarify the permanent full height interior partitions qualification requirement for the use of additional lighting power for wall display lighting.

Section 140.6(c)3Giv – The purpose of the change to this section is to clarify the subsection requirement on how to use the mounting height adjustment factor for wall display lighting luminaires mounted above certain height.

Section 140.6(c)3Gv – The purpose of the change to this section is to clarify the requirement on how to determine the allowed power for wall display lighting.

Section 140.6(c)3Gvi – The purpose of the change to this section is to clarify that lighting integral to display cases can serve and qualify as wall display lighting, provided the display case is attached or adjacent to a wall.

Section 140.6(c)3H – The purpose of the change to this section is to renumber the subsections, as subsections were deleted, and new subsections were added.

Section 140.6(c)3Hi – The purpose of the change to this section is to delete the subsection as the reference to Section 140.6(c)3H no longer exists.

Section 140.6(c)3Hii – The purpose of the change to this section is to clarify that lighting integral to display cases that are not attached or adjacent to a wall should be counted as floor display case lighting. Section numbers were also updated corresponding to changes in the section and subsection numbering as appropriate.

Section 140.6(c)3Hvii – The purpose of the change to this section is to delete the allowance of using IES and Table 140.6-D for determination of additional lighting power for a combination of floor display lighting and task lighting. This corresponds to the change in Section 140.6(c)2A, and is aligned with ASHRAE 90.1-2016 which allows one to choose a reasonably equivalent type to the primary function area in the standard, and design to that lighting power density.

Section 140.6(c)3Hviii – The purpose of the change to this section is to clarify the subsection requirement on how to use the mounting height adjustment factor for floor display lighting luminaires mounted above certain heights.

Section 140.6(c)3Hix – The purpose of the change to this section is to reword the text to more clearly articulate how to determine the allowed power for floor display lighting.

Section 140.6(c)3I – The purpose of the change to this section is to renumber the subsections, as subsections were deleted, and new subsections were added.

Section 140.6(c)3Ii – The purpose of the change to this section is to delete the subsection as the reference to Section 140.6(c)3H no longer exists.

Section 140.6(c)3J – The purpose of the change to this section is to renumber the subsections, as subsections were deleted, and new subsections were added.

Section 140.6(c)3J – The purpose of the change to this section is to delete the subsection as the reference to Section 140.6(c)3H no longer exists.

# 140.6(d)

## Automatic Daylighting Controls in Secondary Daylit Zones

**CHANGE TYPE:** Clarification, Addition, and Modification

**CHANGE SUMMARY:** Code language related to secondary sidelit zones was modified for clarity, and new exceptions were added.

**2019 CODE:**

(d) **Automatic Daylighting Controls in Secondary Daylit Zones.** All luminaires providing general lighting that is in, or partially in a Secondary Sidelit Daylit Zone ~~as defined in Section 130.1(d)1C~~, and that is not in a Primary Sidelit Daylit Zone shall:

1. Be controlled independently from all other luminaires by automatic daylighting controls that meet the applicable requirements of Section 110.9; and
2. Be controlled in accordance with the applicable requirements in Section 130.1(d)~~2~~; and
3. All Secondary Sidelit Daylit Zones shall be shown on the plans submitted to the enforcing agency.

**EXCEPTION 1 to Section 140.6(d):** Luminaires in Secondary Sidelit Daylit Zone(s) in ~~areas~~ an enclosed space in which the combined total general lighting power in Secondary Daylit Zone(s) ~~where the total wattage of general lighting~~ is less than 120 ~~Watts~~watts, or where the combined total general lighting power in Primary and Secondary Daylit Zone(s) is less than 240 watts.

**EXCEPTION 2 to Section 140.6(d):** Luminaires in parking garages complying with Section 130.1(d)3.

**EXCEPTION 3 to Section 140.6(d):** Areas adjacent to vertical glazing below an overhang, where there is no vertical glazing above the overhang and where the ratio of the overhang projection to the overhang rise is greater than 1.5 for South, East and West orientations, or where the ratio of the overhang projection to the overhang rise is greater than 1 for North orientations.

**EXCEPTION 4 to Section 140.6(d):** Rooms that have a total glazing area of less than 24 square feet, or parking garage areas with a combined total of less than 36 square feet of glazing or opening.

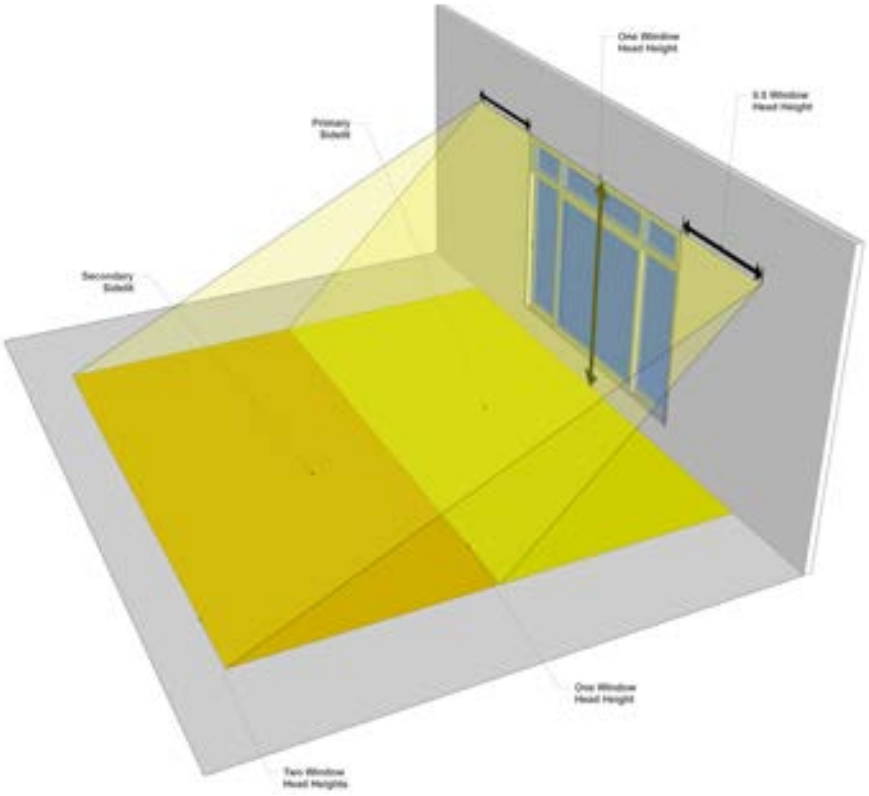
**EXCEPTION 5 to Section 140.6(d):** Luminaires in sidelit daylit zones in retail merchandise sales and wholesale showroom areas.

**CHANGE SIGNIFICANCE:** Section 140.6(d) – Outdated references to daylit zone definitions were removed from this section. The relevant definitions are now located in Section 100.1, the definitions section of the Energy Code. A second reference to daylighting requirements was also changed to reflect that section's renumbering. Lastly, exceptions were added to address circumstances where daylighting may not be effective.

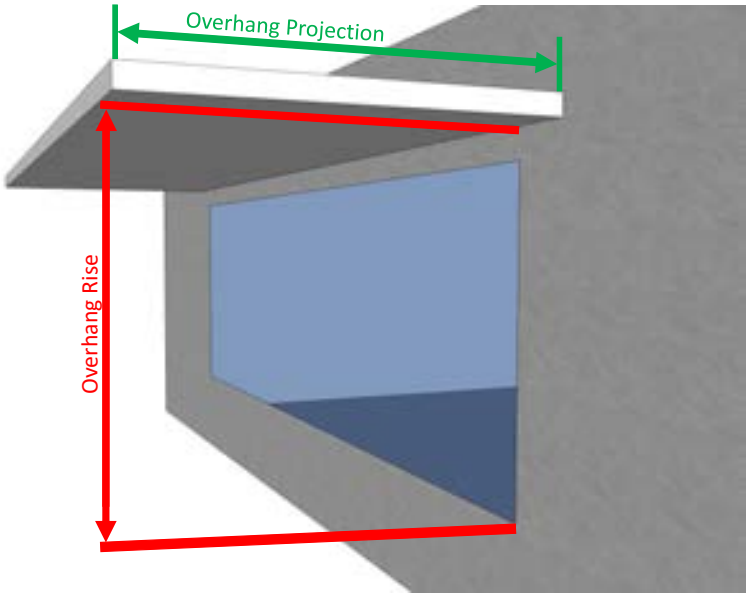
Exception 1 to Section 140.6(d) – The purpose of modifying this exception is to address scenarios where automatic daylighting controls are required in secondary sidelit daylit zones, but not required in primary sidelit daylit zones. The exception now exempts control requirements for secondary sidelit daylit zones if the combined general lighting power in primary and secondary sidelit daylit zones is less than 240 watts.

Exception 3 to Section 140.6(d) – The purpose of adding this exception is to address scenarios with limited access to direct sunlight. In buildings with large overhangs which block direct access to sunlight, sidelit daylit zones will receive a significantly reduced amount of daylighting. Adding Exception 3 was necessary to prevent daylighting controls from being installed where daylighting may not be utilized effectively.

Exception 5 to Section 130.1(d) – The purpose of adding this exception is to address the need for uniform lighting in merchandise sales and wholesale showroom areas. This exception is necessary to address concerns regarding lighting gradients where merchandise is displayed in a sidelit daylit zone.



Sidelit Daylit Zones – The secondary sidelit daylit zone is the dark yellow rectangle in this illustration.
Source: California Energy Commission




Overhangs – Overhangs can limit the amount of daylight that enters a space. For South, East, and West-facing fenestration, if the overhang projection-to-rise ratio is 1.5 or greater, the area adjacent to that fenestration is exempt from the daylighting control requirements. For north-facing fenestration, these areas are exempt if the overhang projection-to-rise ratio is 1.0 or greater. This is detailed in Exception 3 to Section 140.6(d) of the Energy Code.
Source: California Energy Commission

# Tables 140.7-A and 140.7-B

## Lighting Power Allowances

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** Outdoor lighting power allowance tables were updated with reduced lighting power density (LPD) values that reflect LED lighting as the new prescriptive baseline.

**2019 CODE:**

**TABLE 140.7-A GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE**

| ~~Type of Power Allowance~~ | ~~Lighting Zone 0~~ | ~~Lighting Zone 1~~ | ~~Lighting Zone 22~~ | ~~Lighting Zone 32~~ | ~~Lighting Zone 4~~ |
|---|---|---|---|---|---|
| ~~Area Wattage Allowance (AWA)~~ | ~~No allowance[1]~~ | ~~0.020 W/ft²~~ | ~~0.030 W/ft²~~ | ~~0.040 W/ft²~~ | ~~0.050 W/ft²~~ |
| ~~Linear Wattage Allowance (LWA)~~ | | ~~0.15 W/lf~~ | ~~0.25 W/lf~~ | ~~0.35 W/lf~~ | ~~0.45 W/lf~~ |
| ~~Initial Wattage Allowance (IWA)~~ | | ~~340 W~~ | ~~450 W~~ | ~~520 W~~ | ~~640 W~~ |

| Type of Power Allowance | Lighting Zone 0[3] | Lighting Zone 1[3] | Lighting Zone 2[3] | | Lighting Zone 3[3] | | Lighting Zone 4[3] |
|---|---|---|---|---|---|---|---|
| | Asphalt/ Concrete | Asphalt/ Concrete | Asphalt | Concrete[2] | Asphalt | Concrete[2] | Asphalt/ Concrete |
| Area wattage allowance (AWA) | | 0.018 W/ft² | 0.023 W/ft² | 0.025 W/ft² | 0.025 W/ft² | 0.03 W/ft² | 0.03 W/ft² |
| Linear Wattage Allowance (LWA) | No allowance[1] | 0.15 W/lf | 0.17 W/lf | 0.4 W/lf | 0.25 W/lf | 0.4 W/lf | 0.35 W/lf |
| Initial wattage allowance (IWA) | | 180 W | 250 W | 250 W | 350 W | 350 W | 400 W |

1. Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 Watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse, or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed shall meet the maximum zonal lumen limits as specified in Section 130.2(b).
2. Where greater than 50% of the paved surface of a parking lot is finished with concrete. This does not extend beyond the parking lot, and does not include any other General Hardscape areas.
3. Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm – as mandated by local, state, or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna – shall be allowed a 2.0 lighting power allowance multiplier.

**TABLE 140.7-B ADDITIONAL LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS. All area and distance measurements in plan view unless otherwise noted.**

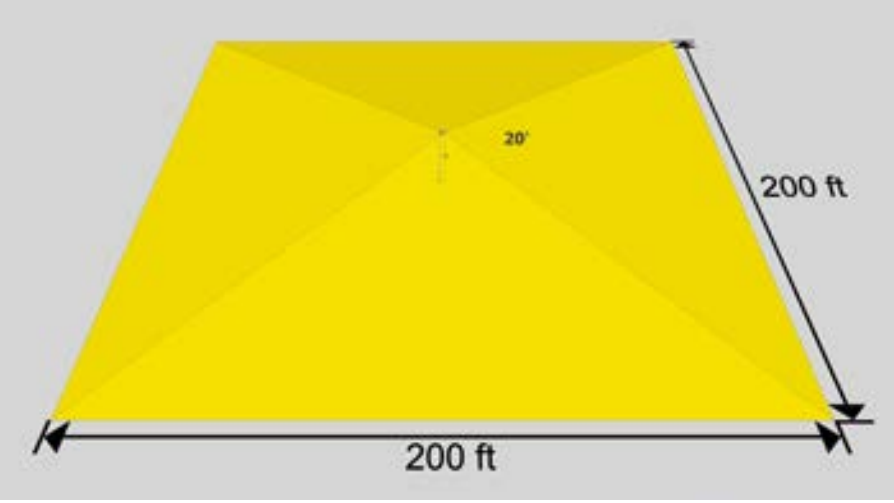
| Lighting Application | Lighting Zone 0 | Lighting Zone 1 | Lighting Zone 2 | Lighting Zone 3 | Lighting Zone 4 |
|---|---|---|---|---|---|
| **WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.** | | | | | |
| **Building Entrances or Exits.** Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door. | Not applicable | ~~15~~ 9 watts | ~~25~~ 15 watts | ~~35~~ 19 watts | ~~45~~ 21 watts |
| **Primary Entrances to Senior Care Facilities, Police Stations, ~~Hospitals~~Healthcare Facilities, 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. | Not applicable | ~~45~~ 20 watts | ~~80~~ 40 watts | ~~120~~ 57 watts | ~~130~~ 60 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. | Not applicable | ~~40~~ 16 watts | ~~75~~ 30 watts | ~~125~~ 50 watts | ~~200~~ 75 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. | Not applicable | ~~120~~ 55 watts | ~~175~~ 77 watts | ~~185~~ 81 watts | ~~330~~ 135 watts |
| **ATM Machine Lighting.** Allowance per ATM machine. Luminaires qualifying for this allowance shall be within 50 feet of the dispenser. | Not applicable | ~~250~~ 100 watts for first ATM machine, ~~70~~ 35 watts for each additional ATM machine. | | | |
| **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. | Not applicable | No Allowance | ~~22.5~~11 W/ linear ft | ~~36~~ 19 W/ linear ft | ~~45~~ 25 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 130.0(d), and shall be post-top luminaires, lanterns, pendant luminaires, or chandeliers. | Not applicable | No Allowance | ~~0.02~~0.007 W/ft² | ~~0.04~~0.013 W/ft² | ~~0.06~~0.019 W/ft² |

**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 0 | Lighting Zone 1 | Lighting Zone 2 | Lighting Zone 3 | Lighting Zone 4 |
|---|---|---|---|---|---|
| **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. | Not applicable | No Allowance | ~~0.180~~.100 W/ft² | ~~0.350~~.170 W/ft² | ~~0.500~~.225 W/ft² |
| **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 nonsales 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. | Not applicable | ~~0.164~~ 0.060 W/ft² | ~~0.5550~~.210 W/ft² | ~~0.7580~~.280 W/ft² | ~~1.285~~ 0.485 W/ft² |
| **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. | Not applicable | ~~0.014~~ 0.006 W/ft² | ~~0.155~~ 0.068 W/ft² | ~~0.308~~ 0.138 W/ft² | ~~0.485~~ 0.200 W/ft² |
| **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. | Not applicable | ~~0.514~~ 0.220 W/ft² | ~~1.005~~ 0.430 W/ft² | ~~1.300~~ 0.580 W/ft² | ~~2.200~~ 1.010 W/ft² |
| **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. | Not applicable | No Allowance | ~~0.655~~ 0.470 W/ft² | ~~0.908~~ 0.622 W/ft² | ~~1.135~~ 0.740 W/ft² |
| **Nonsales Canopies and Tunnels.** Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel. | Not applicable | ~~0.084~~ 0.057 W/ft² | ~~0.205~~ 0.137 W/ft² | ~~0.408~~ 0.270 W/ft² | ~~0.5850~~ 0.370 W/ft² |
| **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. | Not applicable | ~~0.154~~ 0.081 W/ft² | ~~0.355~~ 0.176 W/ft² | ~~0.708~~ 0.325 W/ft² | ~~0.985~~ 0.425 W/ft² |
| **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 two mounting heights of the student pick-up/drop-off zone. | Not applicable | No Allowance | ~~0.12~~ 0.056 W/ft² | ~~0.45~~ 0.200 W/ft² | 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 two mounting heights of the hardscape area of outdoor dining. | Not applicable | ~~0.014~~ 0.004 W/ft² | ~~0.135~~ 0.030 W/ft² | ~~0.240~~ 0.050 W/ft² | ~~0.400~~ 0.075 W/ft² |
| **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. | Not applicable | ~~0.007~~ 0.004 W/ft² | ~~0.009~~ 0.005 W/ft² | ~~0.019~~ 0.010 W/ft² | No Allowance |

**CHANGE SIGNIFICANCE:** Tables 140.7-A and -B – The purpose of the changes to these tables are to update outdoor lighting power allowance values, basing them on LED lighting technologies for all outdoor lighting applications (Table 140.7-A and Table 140.7-B). LED lighting technology is continuing to become more efficient, and associated costs are continuing to drop, making this LED lighting technology cost effective under the 2019 Energy Code Cycle. Updating these values is necessary to reduce the wasteful, uneconomic, inefficient, and unnecessary consumption of energy.

Table 140.7-A – This table has been redesigned to show asphalt and concrete hardscape lighting power allowances for each lighting zone in the body of the table. Concrete hardscape allowances were previously noted in the footnotes to the table. Any hardscape surface that is not asphalt must use the concrete allowances.




Illuminated Hardscape Area – This is defined as the improved area within a square pattern around each luminaire with each side ten times the luminaire mounting height with the luminaire in the middle of the pattern.
Source: California Energy Commission

# 140.8(b)

## Alternate Lighting Sources

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Language relating to sign lighting was updated in response to changes to referenced standard ANSI C82.6-2015.

**2019 CODE:**

**SECTION 140.8 – PRESCRIPTIVE 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.

[…]

(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.

   Ballast efficiency is the ~~measured output wattage to the lam-~~preference lamp power divided by the ~~measured operating input wattage~~ballast input power when tested according to ANSI C82.6-~~2005~~2015.

   […]

**CHANGE SIGNIFICANCE:** Section 140.8(b)2 – The purpose of the change to this section is to update the reference to ANSI C82.6 to its most current version and to update the terminology used in the section for consistency with the updated ANSI standard. This change is necessary to keep pace with updates to industry standards.

# 140.9(a)

## Prescriptive Requirements for Computer Rooms

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Fault detection diagnostics (FDD) requirements were added to the existing economizer requirements for computer rooms, and an exemption from all requirements in this section was added for healthcare facilities.

**2019 CODE:**

(a) **Prescriptive Requirements for Computer Rooms.** Space conditioning systems serving a computer room with a power density greater than 20 W/ft$^2$shall comply with this section by being designed with and having constructed and installed a cooling system that meets the requirements of Subsections 1 through 6.

1. **Economizers.** Each individual cooling system primarily serving computer rooms 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, and be equipped with a fault detection and diagnostic system as specified by Section 120.2(i); 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 to Section 140.9(a):** Computer rooms located in healthcare facilities.

**CHANGE SIGNIFICANCE:** The purpose of this change is to require computer rooms that incorporate an air economizer to comply with the Fault Detection and Diagnostics (FDD). Air economizers serving a computer room suffer from the same operational deficiencies as air economizers serving other space types, and would equally benefit from having on board FDD.

The new exception exempts licensed healthcare facilities from compliance with the prescriptive requirements for computer rooms. This is necessary because this section has been identified as having the potential to interfere with health and safety requirements for technology and computer rooms in healthcare facilities.

Getty Images

Computer Rooms – Computer rooms located in healthcare facilities are exempt from the 2019 Energy Code.

# 140.9(b)

## Prescriptive Requirements for Kitchens

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** An exception from the requirements in this section was added for healthcare facilities.

**2019 CODE:**

(b) **Prescriptive Requirements for Commercial Kitchens.**

[…]

**EXCEPTION to Section 140.9(b):** healthcare facilities.

**CHANGE SIGNIFICANCE:** The purpose of this exception is to exempt licensed healthcare facilities from compliance with commercial kitchen exhaust requirements. This section has been identified as having the potential to interfere with the strict ventilation design requirements necessary for infection control. Future code cycles may remove this exception based on more detailed analysis, add partial exceptions tailored specifically for healthcare, or both.

# 140.9(c)

## Prescriptive Requirements for Laboratory and Factory Exhaust Systems

**CHANGE TYPE:** Modification and Addition

**CHANGE SUMMARY:** This section was expanded to add new requirements for factory exhaust systems.

**2019 CODE:**

(c) **Prescriptive Requirements for Laboratory and Factory Exhaust Systems~~exhaust systems.~~**

1. **Airflow Reduction Requirements.** For buildings with laboratory exhaust systems where the minimum circulation rate to comply with code or accreditation standards is 10 ACH or less, the design exhaust airflow shall be capable of reducing zone exhaust and makeup airflow rates to the regulated minimum circulation rate, or the minimum required to maintain pressurization requirements, whichever is larger. Variable exhaust and makeup airflow shall be coordinated to achieve the required space pressurization at varied levels of demand and fan system capacity.

   **EXCEPTION 1 to Section 140.9(c)1:** 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)1:** New zones on an existing constant volume exhaust system.

2. **Exhaust System Transfer Air.** Conditioned supply air delivered to any space with mechanical exhaust shall comply with the requirements of Section 140.4(o).

3. **Fan System Power Consumption.** All newly installed fan exhaust systems serving a laboratory or factory greater than 10,000 CFM, shall meet subsection A and either B, C, or D:

   A. System shall meet all discharge requirements in ANSI Z9.5-2012.

   B. The exhaust fan system power shall not exceed 0.85 watts per cfm of exhaust air for systems with air filtration, scrubbers, or other air treatment devices. For all other exhaust fan systems the system power shall not exceed 0.65 watts per cfm of exhaust air. Exhaust fan system power equals the sum of the power of all fans in the exhaust system that are required to operate at normal occupied design conditions in order to exhaust air from the conditioned space to the outdoors. Exhaust air does not include entrained air, but does include all exhaust air from fume hoods, hazardous exhaust flows, or other manifolded exhaust streams.

   **EXCEPTION to Section 140.9(c)3B:** Laboratory exhaust systems where applicable local, state, or federal exhaust treatment requirements specify installation of air treatment devices that cause more than 1 in. of water pressure drop.

   C. The volume flow rate at the stack shall vary based on the measured 5-minute averaged wind speed and wind direction obtained from a calibrated local anemometer.

i. At least two anemometers shall be installed in a location that experiences similar wind conditions to the free stream environment above the exhaust stacks and be at a height that is outside the wake region of nearby structures.

ii. Look-up tables shall be used to define the required exhaust volume flow rate, as a function of at least eight wind speeds and eight wind directions, to maintain downwind concentrations below health and odor limits, as defined by the 2018 American Conference of Governmental Industrial Hygienists Threshold Limit Values and Biological Exposure Indices, for all detectable contaminants, or as defined by applicable local, state, or federal jurisdictions, if more stringent.

iii. Wind speed/direction sensors shall be certified by the manufacturer to be accurate within plus or minus 40 fpm (0.2 m/s) and 5.0 degrees when measured at sea level and 25°C, factory calibrated, and certified by the manufacturer to require calibration no more frequently than once every 5 years.

iv. Upon detection of anemometer and/or signal failure, the system shall reset the exhaust volume flow rate to the value needed to maintain downwind concentrations below health and odor limits for all detectable contaminants at worst-case wind conditions and shall report the fault to an Energy Management Control System or fault management application which automatically provides notification of the fault to a remote system provider. The system shall have logic that automatically checks for anemometer failure by the following means.

a. If any anemometer has not been calibrated within the manufacturer's recommended calibration period, the sensor has failed.

b. During unoccupied periods the system compares the readings of all anemometers. If any anemometer is more than 30% above or below the average reading for a period of 4 hours, the anemometer has failed.

v. Before an occupancy permit is granted for a laboratory or process facility subject to Section 140.9(c)3C, the applicable equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7.16. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.16.

D. The volume flow rate at the stack shall vary based on the measured contaminant concentration in the exhaust plenum from a calibrated contaminant sensor installed within each exhaust plenum.

i. A contaminant-event threshold shall be established based on maintaining downwind concentrations below health and odor limits for all detectable chemicals at worst-case wind conditions, as defined by the 2018 American Conference of Governmental Industrial Hygienists Threshold Limit Values and Biological Exposure Indices, or as defined by applicable local, state, or federal jurisdictions, if more stringent.

ii. At least two contaminant concentration sensors shall be Photo Ionization Detectors (PID) certified by the manufacturer to be accurate within plus or minus 5% when measured at sea level and 25°C, factory calibrated, and certified by the manufacturer to require calibration no more frequently than once every 6 months.

iii. Upon detection of sensor and/or signal failure, the system shall reset the exhaust volume flow rate to the value needed to maintain downwind concentrations below health and odor limits for all detectable contaminants at worst-case wind conditions and shall report the fault to an Energy Management Control System or fault management application which automatically provides notification of the fault to a remote system provider. The system shall have logic that automatically checks for sensor failure by the following means.

a. If any sensor has not been calibrated within the manufacturer's recommended calibration period, the sensor has failed.

b. During unoccupied periods the system compares the readings of all sensors. If any sensor is more than 30% above or below the average reading for a period of 4 hours, the sensor has failed.

iv. Before an occupancy permit is granted for a laboratory or process facility subject to Section 140.9(c)3D, the applicable equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7.16. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.16.

4. **Fume Hood Automatic Sash Closure.** Variable air volume laboratory fume hoods with vertical only sashes located in fume hood intensive laboratories, as described in Table 140.9-B, shall have an automatic sash closure system that complies with the following:

A. The automatic sash closure system shall be capable of the following:

i. The automatic sash closure system shall have a dedicated zone presence sensor that detects people in the area near

the fume hood sash and automatically closes the sash within 5 minutes of no detection.

ii. The automatic sash closure system shall have controls to prevent the sash from automatic closing when a force of no more than 10 lbs is detected.

iii. The automatic sash closure system shall be equipped with an obstruction sensor that prevents the sash from automatic closing with obstructions in the sash opening. Obstruction sensor shall be capable of sensing transparent materials such as laboratory glassware.

iv. The automatic sash closure system shall be capable of being configured in a manual open mode where once the sash is closed, detection of people in the area near the fume hood by the zone presence sensor does not open the fume hood sash.

B. Fume Hood Automatic Sash Closure Acceptance. Before an occupancy permit is granted for the fume hoods subject to 140.9(c)4, the equipment and systems shall be certified as meeting the Acceptance Requirement 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 NA7.17.

**Table 140.9-B Fume Hood Intensive Laboratories**

| Occupied Minimum Ventilation ACH | ≤ 4 | > 4 and ≤ 6 | > 6 and ≤ 8 | > 8 and ≤ 10 | > 10 and ≤ 12 | > 12 and ≤ 14 |
|---|---|---|---|---|---|---|
| Hood Density (linear feet per 10,000 $ft^3$ of laboratory space | ≥ 6 | ≥ 8 | ≥ 10 | ≥ 12 | ≥ 14 | ≥ 16 |

**EXCEPTION to Section 140.9(c):** healthcare facilities.

**CHANGE SIGNIFICANCE:** The scope of this section now includes factory exhaust systems in addition to laboratory exhaust systems. Requirements have been added for exhaust system transfer air [Section 140.9(c)2], fan system power consumption [Section 140.9(c)3], and fume hood automatic sash closure [Section 140.9(c)4].

Exception to Section 140.9(c) – The purpose of this exception is to exempt licensed healthcare facilities from compliance with laboratory exhaust system requirements. This section has been identified as having the potential to interfere with the strict ventilation design requirements necessary for infection control. Future code cycles may remove this exception based on more detailed analysis, add partial exceptions tailored specifically for healthcare, or both.

Section 140.9(c)1 – Airflow Reduction Requirements. A title was added to this paragraph and it was numbered to accommodate the additional requirements of this section. The efficiency requirements in this subsection have not changed from the 2016 Energy Code.

Section 140.9(c)2 – Exhaust System Transfer Air. This new section limits the amount of conditioned air supplied to a space with mechanical exhaust by taking advantage of available transfer air. By using transfer air, the amount of air that needs to be conditioned is reduced, thus saving energy.

Section 140.9(c)3 – Fan System Power Consumption. Newly installed laboratory and factory exhaust systems greater than 10,000 CFM must meet the discharge requirements of ANSI Z9.5, and one of three prescriptive pathways to reduce fan system power. The prescriptive pathways are based on either fan system efficacy (watts/cfm), variable volume stack flow rate based on wind speed at the stack, or variable volume stack flow rate based on exhaust contaminant concentration.

Section 140.9(c)3 – Fume Hood Automatic Sash Closure. Fume hood intense laboratories with variable air volume HVAC systems and vertical fume hood sashes are prescriptively required to install automatic sash closure systems. For this measure, fume hood intensive means the air change rate of the space is driven by the fume hood exhaust and not the minimum ventilation requirements. The automatic closure system must be triggered by zone presence sensors within 5 minutes of vacancy. The system must have sash closure safeguards and must have a manual open mode. This measure saves energy by reducing laboratory exhaust air and makeup air conditioning.

PART 6

# Nonresidential, High-Rise Residential and Hotel/Motel Occupancies—Additions, Alterations, and Repairs

## Subchapter 6

Subchapter 6 identifies which sections of the Energy Code apply to additions and alterations to existing nonresidential, high-rise residential, hotel/motel buildings, and covered processes. This subchapter also identifies specific variances from the previous sections of the Energy Code for additions and alterations to these buildings and systems. All requirements for additions and alterations to these existing buildings are defined within Section 141.0, and this section refers to other applicable sections of the Energy Code, depending on the scope of work. Applicable requirements for additions and alterations to existing covered processes are found in Section 141.1. ■

**141.0**

**Additions, Alterations, and Repairs to Existing Nonresidential, High-rise Residential, and Hotel/Motel Buildings, to Existing Outdoor Lighting, and to Internally and Externally Illuminated Signs**

**141.0(a)**

**Additions**

**141.0(a)1 and 2**

**Prescriptive Approach and Performance Approach**

**141.0(b)**

**Alterations**

**141.0(b)2A NOTE**

**Prescriptive Approach, Fenestration Alterations**

**141.0(b)2C**

**Prescriptive Approach, New or Replacement Space-Conditioning Systems or Components**

**141.0(b)2E**

**Prescriptive Approach, Altered Space-Conditioning Systems**

**141.0(b)2I – K**

**Prescriptive Approach, Altered Indoor Lighting Systems**

**141.1**

**Requirements for Covered Processes in Additions, Alterations to Existing Nonresidential, High-Rise Residential, And Hotel/Motel Buildings**

# 141.0

## Additions, Alterations and Repairs to Existing Nonresidential„ High-rise Residential, and Hotel/Motel Buildings, to Existing Outdoor Lighting, and to Internally and Externally Illuminated Signs

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** An exception was added to exclude alterations to healthcare facilities from the Energy Code.

**2019 CODE:**

**SECTION 141.0 – ADDITIONS, ALTERATIONS AND REPAIRS TO EXISTING NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS**

Additions, alterations, and repairs to existing nonresidential, high-rise residential, and hotel/motel buildings, existing outdoor lighting for these occupancies, and internally and externally illuminated signs, shall meet the requirements specified in Sections 100.0 through 110.10, and 120.0 through 130.5 that are applicable to the building project, and either the performance compliance approach (energy budgets) in Section 141.0(a)2 (for additions) or 141.0(b)3 (for alterations), or the prescriptive compliance approach in Section 141.0(a)1 (for additions) or 141.0(b)2 (for alterations), for the Climate Zone in which the building is located. Climate zones are shown in Figure 100.1-A.

Covered process requirements for additions, alterations and repairs to existing nonresidential, high-rise residential, and hotel/motel buildings are specified in Section 141.1.

**EXCEPTION to Section 141.0:** Alterations to healthcare facilities are not required to comply with this Section.

[…]

**CHANGE SIGNIFICANCE:** The purpose of this exception is to exempt alterations and repairs to licensed healthcare facilities from compliance with this code section. This exception is necessary because licensed healthcare facilities are being brought into the scope of the Energy Code for the first time, but applying the alteration requirements in this section to licensed healthcare facilities has been identified as potentially not being cost effective. Future code cycles may remove this exception based on more detailed analysis, add partial exceptions tailored specifically for healthcare, or both.

# 141.0(a)1 and 2

## Additions, Prescriptive Approach and Performance Approach

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Section 120.8 is not applicable to additions, and thus was removed from this section.

**2019 CODE:**

(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 system, electrical power distribution system, or water-heating system; 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 120.7, 120.9 through 130.5, and Sections 140.2 through 140.9.
2. **Performance approach.**
   A. The envelope and indoor lighting in the conditioned space of the addition, and any newly installed space-conditioning system, electrical power distribution system, or water-heating system, shall meet the applicable requirements of Sections 110.0 through 120.7, 120.9 through 130.5; and

   […]

**CHANGE SIGNIFICANCE:** Section 120.8 was removed from the sections referenced for the prescriptive and performance approach for additions. This was done to clarify that the commissioning requirements of Section 120.8 do not apply to additions. To the extent Section 120.8 could have been read as applying to additions to existing buildings, this change has the substantive effect of limiting commissioning requirements to newly constructed buildings. The change otherwise clarifies without materially altering the requirements in the Energy Code.

# 141.0(b)2A Note

## Alterations, Prescriptive Approach Fenestration Alterations

**CHANGE TYPE:** Addition and Clarification

**CHANGE SUMMARY:** A note was added to provide distinction between fenestration alterations and repairs.

**2019 CODE:**

(b) **Alterations.** Alterations to components of existing nonresidential, high-rise residential, ~~or~~ hotel/motel ~~buildings~~, or relocatable public school buildings, ~~or~~ including alterations made in conjunction with a change in building occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy ~~are not subject to Subsection (a) and~~ shall meet item 1, and either Item 2 or 3 below:

[…]

2. **Prescriptive approach.** The altered components of the envelope, or space conditioning, lighting, electrical power distribution and water heating systems, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 120.0 through 120.6, and Sections 120.9 through 130.5.

   […]

   A. Fenestration alterations other than repair and those subject to Section 141.0(b)2 shall meet the requirements below:

      i. Vertical fenestration alterations shall meet the requirements in Table 141.0-A.

      ii. Added vertical fenestration shall meet the requirements of TABLE 140.3-B, C, or D.

      iii. All altered or newly installed skylights shall meet the requirements of TABLE 140.3-B, C or D.

      **EXCEPTION 1 to Section 141.0(b)2Ai:** ~~Replacing~~ In an alteration, where 150 square feet or less of the entire building's vertical fenestration is replaced, RSHGC and VT requirements of TABLE 141.0-A shall not apply.

      **EXCEPTION 2 to Section 141.0(b)2Aii:** In an alteration, where 50 square feet or less of vertical fenestration is added, RSHGC and VT requirements of TABLE 140.3-B, C or D shall not apply.

      **EXCEPTION 3 to Section 141.0(b)2Aiii:** In an alteration, where 50 square feet or less of skylight is added, SHGC and VT requirements of TABLE 140.3-B, C or D shall not apply.

   **NOTE:** Glass replaced in an existing sash and frame or sashes replaced in an existing frame are considered repairs. In these cases, Section 141.0(c) requires that the replacement be at least equivalent to the original in performance.

**TABLE 141.0-A ALTERED VERTICAL FENESTRATION MAXIMUM *U*-FACTOR AND MAXIMUM RSHGC**

| 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 |
| VT | See TABLE 140.3-B, C, and D for all climate zones | | | | | | | | | | | | | | | |

**CHANGE SIGNIFICANCE:** The purpose of the changes to Section 141.0(b)2A is to correct grammar, and to add a note providing distinction between an alteration and a repair. The note matches language found in the low-rise residential alterations section, Section 150.2(b)1B, and in the definition of the term "Fenestration Repair" in Section 100.1. These changes clarify without materially altering the requirements.

# 141.0(b)2C

## Alterations, Prescriptive Approach, New or Replacement Space-Conditioning Systems or Components

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** A pressure drop allowance was added for filtration devices that are added as part of a new or replacement space-conditioning system or component alteration.

**2019 CODE:**

(b) **Alterations.** Alterations to components of existing nonresidential, high-rise residential, ~~or~~ hotel/motel ~~buildings,~~ or relocatable public school buildings, ~~or~~ including alterations made in conjunction with a change in building occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy ~~are not subject to Subsection~~ (a) and shall meet item 1, and either Item 2 or 3 below:

[…]

2. **Prescriptive approach.** The altered components of the envelope, or space conditioning, lighting, electrical power distribution and water heating systems, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 120.0 through 120.6, and Sections 120.9 through 130.5.

   […]

   C. **New or Replacement Space-Conditioning Systems or Components** other than new or replacement space-conditioning system ducts shall meet the requirements of Section 140.4 applicable to the systems or components being altered. For compliance with Section 140.4(c)1, additional fan power adjustment credits are available as specified in Table 141.0-D.

**Table 141.0-D Fan Power Limitation Pressure Drop Adjustment**

| DEVICE | ADJUSTMENT CREDITS |
|---|---|
| Particulate Filtration Credit: MERV 9 through 12 | 0.5 in. of water |
| Particulate Filtration Credit: MERV 13 through 15 | 0.9 in. of water |

**CHANGE SIGNIFICANCE:** The purpose of this change is to provide a pressure drop credit to allow additional fan power that may be needed to support the inclusion of filtration devices. This change is needed to promote the use of filtration devices in nonresidential alterations where MERV 13 filtration is not required. MERV 13 filtration is only required for a nonresidential alteration when the entire system, including the ducts, are replaced.

# 141.0(b)2E

## Alterations, Prescriptive Approach, Altered Space-Conditioning Systems

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Reference locations for demand response and duct sealing requirements for altered space-conditioning systems were changed due to reorganization of the code.

**2019 CODE:**

(b) **Alterations.** Alterations to components of existing nonresidential, high-rise residential, ~~or~~ hotel/motel ~~buildings~~, or relocatable public school buildings, ~~or~~ including alterations made in conjunction with a change in building occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy ~~are not subject to Subsection (a)~~ and shall meet item 1, and either Item 2 or 3 below:

[…]

2. **Prescriptive approach.** The altered components of the envelope, or space conditioning, lighting, electrical power distribution and water heating systems, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 120.0 through 120.6, and Sections 120.9 through 130.5.

   […]

   E. **Altered Space-Conditioning Systems.** When a space-conditioning system is altered by the installation or replacement of space-conditioning system equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil:

      i. For all altered units where the existing thermostat does not comply with ~~Reference Joint Appendix JA5~~the requirements for demand responsive controls specified in Section 110.12, the existing thermostat shall be replaced with a demand responsive thermostat that complies with ~~Reference Joint Appendix JA5~~Section 110.12. All newly installed space-conditioning systems requiring a thermostat shall be equipped with a demand responsive thermostat that complies with ~~Reference Joint Appendix JA5~~Section 110.12; and

      ii. The duct system that is connected to the new or replaced space-conditioning system equipment shall be sealed, if the duct system meets the criteria of Sections 140.4(l)1, ~~2 and 3~~, as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures for duct sealing of altered existing duct systems as specified in Reference Nonresidential Appendix NA2, and conforming to the applicable leakage compliance criteria in Section 141.0(b)2D.

**EXCEPTION 1 to Section 141.0(b)2Eii: Duct Sealing.** Buildings altered so that the duct system no longer meets the criteria

of Sections 140.4 (l)1, ~~2, and 3~~ are exempt from the requirements of Subsection 141.0(b)2Eii.

**EXCEPTION 2 to Section 141.0(b)2Eii: Duct Sealing.** Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in the Reference Nonresidential Appendix NA2 are exempt from the requirements of Subsection 141.0(b)2Eii.

**EXCEPTION 3 to Section 141.0(b)2Eii: Duct Sealing.** Existing duct systems constructed, insulated or sealed with asbestos are exempt from the requirements of Subsection 141.0(b)2Eii.

**CHANGE SIGNIFICANCE:** Section 141.0(b)2E – The purpose of the changes is to reference Section 110.12, Mandatory Requirements for Demand Management, and Section 140.4(l)1, Air Distribution System Duct Leakage Sealing. Section 110.12 was added to consolidate all requirements relating to demand responsive controls. Duct leakage requirements were moved and consolidated into Section 140.4(l)1.

# 141.0(b)2I – K

## Alterations, Prescriptive Approach Altered Indoor Lighting Systems

**CHANGE TYPE:** Modification, Clarification

**CHANGE SUMMARY:** Existing language was condensed, and thresholds and control requirements were standardized across all types of indoor lighting system alterations.

**2019 CODE:**

(b) **Alterations.** Alterations to components of existing nonresidential, high-rise residential, ~~or~~ hotel/motel ~~buildings~~, or relocatable public school buildings, ~~or~~ including alterations made in conjunction with a change in building occupancy to a nonresidential, high-rise residential, or hotel/motel occupancy ~~are not subject to Subsection (a) and~~ shall meet item 1, and either Item 2 or 3 below:

[…]

2. **Prescriptive approach.** The altered components of the envelope, or space conditioning, lighting, electrical power distribution and water heating systems, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 120.0 through 120.6, and Sections 120.9 through 130.5.

   […]

   I. **Altered Indoor Lighting Systems.** Alterations to indoor lighting systems that include 10% or more of the luminaires serving an enclosed space shall meet the requirements of i, ii, or iii below:

      i. The alteration shall comply with the indoor lighting power requirements specified in Section 140.6 and the lighting control requirements specified in Table 141.0-F;

      ii. The alteration shall not exceed 80% of the indoor lighting power requirements specified in Section 140.6, and shall comply with the lighting control requirements specified in Table 141.0-F; or

      iii. The alteration shall be a one-for-one luminaire alteration within a building or tenant space of 5,000 square feet or less, the total wattage of the altered luminaires shall be at least 40% lower compared to their total pre-alteration wattage, and the alteration shall comply with the lighting control requirements specified in Table 141.0-F.

   Alterations to indoor lighting systems shall not prevent the operation of existing, unaltered controls, and shall not alter controls to remove functions specified in Section 130.1.

   Alterations to lighting wiring are considered alterations to the lighting system. Alterations to indoor lighting systems are not required to separate existing general, floor, wall, display, or ornamental lighting on shared circuits or controls. New or completely replaced lighting circuits shall comply with the control separation requirements of Section 130.1(a)3 and 130.1(c)1D.

**EXCEPTION 1 to Section 141.0(b)2I.** Alteration of portable luminaires, luminaires affixed to moveable partitions, or lighting excluded as specified in Section 140.6(a)3.

**EXCEPTION 2 to Section 141.0(b)2I.** Any enclosed space with only one luminaire.

**EXCEPTION 3 to Section 141.0(b)2I.** Any alteration that would directly cause the disturbance of asbestos, unless the alteration is made in conjunction with asbestos abatement.

**EXCEPTION 4 to Section 141.0(b)2I.** Acceptance testing requirements of Section 130.4 are not required for alterations where lighting controls are added to control 20 or fewer luminaires.

**EXCEPTION 5 to Section 141.0(b)2I.** Any alteration limited to adding lighting controls or replacing lamps, ballasts, or drivers.

**EXCEPTION 6 to Section 141.0(b)2I.** One-for-one luminaire alteration of up to 50 luminaires either per complete floor of the building or per complete tenant space, per annum.

~~**Entire Luminaire Alterations.** Entire luminaire alterations shall meet the following requirements:~~

~~i. For each enclosed space, alterations that consist of either (a) removing and reinstalling a total of 10 percent or more of the existing luminaires; or (b) replacing or adding entire luminaires; or (c) adding, removing, or replacing walls or ceilings along with any redesign of the lighting system, shall meet the lighting power allowance in Section 140.6, and the altered luminaires shall meet the applicable requirements in Table 141.0-E; or~~

~~ii. For alterations where existing luminaires are replaced with new luminaires, and that do not include adding, removing, or replacing walls or ceilings along with redesign of the lighting system, the replacement luminaires in each office, retail, and hotel occupancy shall have at least 50 percent, and in all other occupancies at least 35 percent, lower rated power at full light output compared to the existing luminaires being replaced, and shall meet the requirements of Sections 130.1(a)1, 2, and 3, 130.1(c)1A through C, 130.1(c)2, 130.1(c)3, 130.1(c)4, 130.1(c)5, 130.1(c)6A, and for parking garages 130.1(c)7B.~~

~~**EXCEPTION 1 to Section 141.0(b)2I.** Alteration of portable luminaires, luminaires affixed to moveable partitions, or lighting excluded as specified in Section 140.6(a)3.~~

~~**EXCEPTION 2 to Section 141.0(b)2I.** In an enclosed space where two or fewer luminaires are replaced or reinstalled.~~

~~**EXCEPTION 3 to Section 141.0(b)2I.** Alterations that would directly cause the disturbance of asbestos, unless the alterations are made in conjunction with asbestos abatement.~~

~~**EXCEPTION 4 to Section 141.0(b)2I.** Acceptance testing requirements of Section 130.4 are not required for alterations where lighting controls are added to control 20 or fewer luminaires.~~

J. **Reserved.~~Luminaire Component Modifications.~~** ~~Luminaire component modifications in place that include replacing the ballasts or drivers and the associated lamps in the luminaire, permanently changing the light source of the luminaire, or changing the optical system of the luminaire, where 70 or more existing luminaires are modified either on any single floor of a building or, where multiple tenants inhabit the same floor, in any single tenant space, in any single year, shall not prevent or disable the operation of any multi-level, shut-off, or daylighting controls, and shall:~~

i. ~~Meet the lighting power allowance in Section 140.6 and comply with Table 141.0-E; or~~

ii. ~~In office, retail, and hotel occupancies have at least 50 percent, and in all other occupancies have at least 35 percent, lower rated power at full light output as compared to the original luminaires prior to being modified, and meet the requirements of Sections 130.1(a)1, 2, and 3, 130.1(c)1A through C, 130.1(c)2, 130.1(c)3, 130.1(c)4, 130.1(c)5, 130.1(c)6A, and for parking garages 130.1(c)7B.~~

~~Lamp replacements alone and ballast replacements alone shall not be considered a modification of the luminaire provided that the replacement lamps or ballasts are installed and powered without modifying the luminaire.~~

**~~EXCEPTION 1 to Section 141.0(b)2J.~~** ~~Modification of portable luminaires, luminaires affixed to moveable partitions, or lighting excluded by Section 140.6(a)3.~~

**~~EXCEPTION 2 to Section 141.0(b)2J.~~** ~~In an enclosed space where two or fewer luminaires are modified.~~

**~~EXCEPTION 3 to Section 141.0(b)2J.~~** ~~Modifications that would directly cause the disturbance of asbestos, unless the modifications are made in conjunction with asbestos abatement.~~

**~~EXCEPTION 4 to Section 141.0(b)2J.~~** ~~Acceptance testing requirements of Section 130.4 are not required for modifications where lighting controls are added to control 20 or fewer luminaires.~~

K. **Reserved.~~Lighting Wiring Alterations.~~** ~~For each enclosed space, wiring alterations that add a circuit feeding luminaires; that replace, modify, or relocate wiring between a switch or panelboard and luminaires; or that replace lighting control panels, panelboards, or branch circuit wiring; shall:~~

i. ~~meet the lighting power allowance in Section 140.6;~~

ii. ~~meet the requirements in Sections 130.1(a)1, 2, and 3, 130.1(c)1A through C, 130.1(c)3, and 130.1(c)4;~~

iii. ~~for each enclosed space, be wired to create a minimum of one step between 30-70 percent of lighting power or meet Section 130.1(b); and~~

iv. ~~for each enclosed space where wiring alterations include 10 or more luminaires that provide general lighting within~~

the primary sidelit daylit zone or the skylit daylit zone, meet the requirements of 130.1(d).

**NOTE:** As specified in Section 141.0(b)2I, alterations that include adding, removing, or replacing walls or ceilings resulting in redesign of the lighting system shall meet the requirements of Table 141.0-E.

**EXCEPTION 1 to Section 141.0(b)2K.** Alterations strictly limited to addition of lighting controls.

**EXCEPTION 2 to Section 141.0(b)2K.** In an enclosed space where wiring alterations involve two or fewer luminaires.

**EXCEPTION 3 to Section 141.0(b)2K.** Alterations that would directly cause the disturbance of asbestos, unless the alterations are made in conjunction with asbestos abatement.

**EXCEPTION 4 to Section 141.0(b)2K.** Acceptance testing requirements of Section 130.4 are not required for wiring alterations where lighting controls are added to control 20 or fewer luminaires.

**TABLE 141.0-E Control Requirements for Entire Luminaire Alterations**

| Control requirements that shall be met | Resulting lighting power, compared to the lighting power allowance specified in Section 140.6(c)2, Area Category Method | |
|---|---|---|
| | Lighting power is ≤ 85% of allowance | Lighting power is > 85% to 100% of allowance |
| Section 130.1(a)1, 2, and 3 Area Controls | Yes | Yes |
| Section 130.1(b) Multi-Level Lighting Controls – only for alterations to general lighting of enclosed spaces 100 square feet or larger with a connected lighting load that exceeds 0.5 watts per square foot | For each enclosed space, minimum one step between 30-70 percent of lighting power regardless of luminaire type, or meet Section 130.1(b) | Yes |
| Section 130.1(c) Shut-Off Controls | Yes | Yes |
| Section 130.1(d) Automatic Daylight Controls | Not Required | Yes |
| Section 130.1(e) Demand Responsive Controls – only for alterations > 10,000 $ft^2$ in a single building, where the alteration also changes the area of the space, or changes the occupancy type of the space, or increases the lighting power | Not Required | Yes |

**TABLE 141.0-F Control Requirements for Indoor Lighting System Alterations**

| Control Specifications | Projects complying with Section 141.0(b)2Ii | Projects complying with Sections 141.0(b)2Iii and 141.0(b)2Iiii | |
|---|---|---|---|
| Manual Area Controls | 130.1(a)1 | Required | Required |
| | 130.1(a)2 | Required | Required |
| | 130.1(a)3 | Only required for new or completely replaced circuits | Only required for new or completely replaced circuits |
| Multilevel Controls | 130.1(b) | Required | Not Required |
| Automatic Shut Off Controls | 130.1(c)1 | Required; 130.1(c)1D only required for new or completely replaced circuits | Required; 130.1(c)1D only required for new or completely replaced circuits |
| | 130.1(c)2 | Required | Required |
| | 130.1(c)3 | Required | Required |
| | 130.1(c)4 | Required | Required |
| | 130.1(c)5 | Required | Required |
| | 130.1(c)6 | Required | Required |
| | 130.1(c)7 | Required | Required |
| | 130.1(c)8 | Required | Required |
| Daylighting Controls | 130.1(d) | Required | Not Required |
| Demand Responsive Controls | 130.1(e) | Required | Not Required |

**CHANGE SIGNIFICANCE:** Section 141.0(b)2I, J, K, and Table 141.0-E – Unnecessary distinctions between different types of alterations to a nonresidential building's indoor lighting system were eliminated for clarity. Control requirements for lighting system alterations were also standardized to simplify requirements and their applicability. An exception was also altered to limit the applicability of the lighting alteration requirements to spaces with two or more luminaires. Limits were also added to the simplified alteration requirements for projects when existing installed lighting power can be reduced significantly.

### Sections 141.0(b)2I, J, and K were merged

Indoor lighting alterations are no longer separated into three distinct types (entire luminaire alteration, luminaire component modification, and lighting wiring alteration). These three sections were condensed into a single section titled "Altered Indoor Lighting Systems," which encompasses any indoor lighting alteration where 10 percent or more of the luminaires in an enclosed space are altered.

This change simplifies and clarifies the requirements by standardizing the threshold for triggering indoor lighting system alterations for all project types, and by standardizing the associated lighting control requirements for all types of indoor lighting alterations.

**Indoor lighting alteration compliance pathway utilizing 80 percent or less of the allowed lighting power**

The indoor lighting alteration compliance pathway for utilizing 85 percent or less of allowed indoor lighting power has changed. Under the 2016 Energy Code, projects with proposed lighting power of 85 percent or less of the allowed lighting power were subject to less stringent control requirements. Under the 2019 Energy Code, the 85 percent threshold has been reduced to 80 percent of the allowed lighting power. The requirement for bi-level lighting controls has been removed to account for this change, which substantially reduces the allowed wattage for projects utilizing this compliance pathway.

**Indoor lighting alteration compliance pathway utilizing the reduction of existing lighting power**

The compliance pathway for reduction to the existing lighting power is now limited to buildings or tenant spaces that are 5,000 square feet or less, and only for one-for-one luminaire alterations. Larger remodeling projects or more extensive lighting system alterations can no longer use this compliance pathway. This ensures that projects where detailed plans with square foot information for each space is available make use of those plans, rather than basing compliance on the existing lighting, which can vary significantly between buildings.

Projects using this compliance pathway are now required to install partial-OFF controls in corridors, stairwells, and library book stack aisles. This is necessary to ensure compliance with Section 1008 of the *California Building Code*'s requirement to provide means of egress illumination.

Under the 2016 Energy Code, projects could utilize this compliance pathway if the proposed lighting power reduction from existing was at least 35 percent in most space types, and at least 50 percent in office, hotel, motel, and retail spaces. To simplify these requirements, all spaces are now required to demonstrate at least a 40 percent reduction compared to replaced luminaires.

**Exception to indoor lighting alteration requirements for spaces with no more than one luminaire**

The 2016 exception to indoor lighting alterations for spaces with two or fewer luminaires was found to exempt larger spaces than was intended. The exception was drafted with an assumption of luminaires using fluorescent lamps, however LED luminaires are available in several form factors that illuminate significantly larger spaces than fluorescent luminaires. For this reason, this exception was reduced to spaces with a single luminaire to preserve its intent.

Getty Images

Lighting Alterations – Requirements for these alterations have been modified for simplicity.

# 141.1

## Requirements for Covered Processes in Additions, Alterations to Existing Nonresidential, High-Rise Residential, And Hotel/Motel Buildings

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** A minimum exhaust system flow rate was added for laboratory and process facility exhaust systems to exclude smaller systems from the requirements of this section.

**2019 CODE:**

**SECTION 141.1 – REQUIREMENTS FOR COVERED PROCESSES IN ADDITIONS, ALTERATIONS TO EXISTING NONRESIDENTIAL, HIGH-RISE RESIDENTIAL, AND HOTEL/MOTEL BUILDINGS**

Covered processes in additions or alterations to existing buildings that will be nonresidential, high-rise residential, and hotel/motel occupancies shall comply with the applicable subsections of Section 120.6 and 140.9.

**Lab and Process Facility Exhaust Systems.** All newly installed fan systems for a laboratory or process facility exhaust system greater than 10,000 CFM shall meet the requirements of Section 140.9(c).

**NOTE:** For alterations that change the occupancy classification of the building, the requirements of Section 141.1 apply to the occupancy that will exist after the alterations.

[…]

**CHANGE SIGNIFICANCE:** The purpose of the change is to exclude smaller exhaust systems from the requirements for additions and alterations. This change is necessary to avoid requirements which may not be cost effective for smaller systems.

PART 7

# Low-Rise Residential Buildings—Mandatory Features and Devices

## Subchapter 7

Subchapter 7 identifies mandatory requirements strictly for low-rise residential buildings. Subchapter 7 consists solely of Section 150.0. All measures in this section are mandatory and cannot be traded away via the performance approach. These measures establish a minimum level of energy efficiency for multiple building features of low-rise residential buildings, including measures related to energy efficiency and to indoor air quality. ■

**150.0**
Mandatory Features and Devices

**150.0(c)**
Wall Insulation

**150.0(d)**
Raised Floor Insulation

**150.0(e)**
Installation of Fireplaces, Decorative Gas Appliances, and Gas Logs

**150.0(j)**
Insulation for Piping and Tanks

**150.0(j)2**
Water piping, solar water-heating system piping, and space conditioning system line insulation thickness and conductivity

**150.0(j)3**
Insulation Protection

**150.0(k)**
Residential Lighting

**150.0(k)1**
Luminaire Requirements

**TABLE 150.0-A**
Classification of High Efficacy Light Sources

**150.0(k)2**
Interior Lighting Switching Devices and Controls

**150.0(k)3**
Outdoor Lighting

**150.0(k)4**
Internally Illuminated Address Signs

**150.0(k)6**
Interior Common Areas of Low-rise Multifamily Residential Buildings

**150.0(m)**
Air-Distribution and Ventilation System Ducts, Plenums, and Fans

**150.0(m)1**
CMC Compliance

**150.0(m)10**

Porous Inner Core Flex Duct

**150.0(m)12**

Air Filtration

**150.0(m)13B**

Single Zone Central Forced Air Systems; Airflow Rate and Fan Efficacy

**150.0(m)13C**

Space Conditioning System Airflow Rate and Fan Efficacy; Zonally Controlled Central Forced Air Systems

**150.0(m)13D**

Space Conditioning System Airflow Rate and Fan Efficacy; Small Duct High Velocity Forced Air Systems

**150.0(n)**

Water Heating System

**150.0(o)**

Requirements for Ventilation and Indoor Air Quality

**150.0(o)1**

Amendments to ASHRAE 62.2

**150.0(o)2**

Field Verification and Diagnostic Testing

# 150.0(c)
## Wall Insulation

**CHANGE TYPE:** Modification and Clarification

**CHANGE SUMMARY:** Mandatory wall insulation requirements were increased for 2 × 6 wood-framed walls and masonry walls in newly constructed low-rise residential buildings, and clarified language.

**2019 CODE:**

(c) **Wall Insulation.** Opaque portions of above grade walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the following requirements ~~of Items 1, 2, 3 and 4 below~~:

1. 2 × 4 inch framing shall have an overall assembly *U*-factor not exceeding U-0.102~~, equivalent to an installed R-value of 13 in a wood framed assembly~~.

   **EXCEPTION to Section 150.0(c)1:** Existing walls already insulated to a *U*-factor not exceeding U-0.110 or already insulated between framing members with insulation having an installed thermal resistance of R-11 or greater.

2. 2 × 6 inch or greater framing shall have an overall assembly *U*-factor not exceeding U-~~0.074~~0.071 ~~or an installed R-value of 19 in a wood framed assembly~~.

3. Opaque nonframed assemblies shall have an overall assembly *U*-factor not exceeding U-0.102~~, equivalent to an installed R-value of 13 in a wood framed assembly~~.

4. Bay or Bow Window roofs and floors shall be insulated to meet the wall insulation requirements of TABLE 150.1-A or B.

5. Masonry walls shall be insulated to meet the wall insulation requirements of TABLE 150.1-A or B.

6. In wood framed assemblies, compliance with *U*-factors may be demonstrated by installing wall insulation with an R-value of 13 in 2 × 4 assemblies, and 20 in 2 × 6 assemblies.

**CHANGE SIGNIFICANCE:** In 1978, California's first Energy Code required basic levels of insulation. Insulation is a primary focus in the 2019 Energy Code. New low-rise residential homes will gain additional energy savings from building component technology and installation best practices. The increased mandatory insulation levels in Section 150.0(c)6 for 2 × 6 wood-framed walls will require a higher density batt, or alternative insulation materials to achieve R-20 within the 2 × 6 cavity.

The 2016 Energy Code's prescriptive insulation requirements for masonry walls have now become the mandatory insulation requirements for mass walls under the 2019 Energy Code. These insulation requirements are as follows:

For mass walls with insulation installed on the interior side of the wall:

- Climate Zones 1–15
  - Minimum R-13 continuous insulation, or maximum *U*-factor of 0.077.

- Climate Zone 16
  - Minimum R-17 continuous insulation, or maximum *U*-factor of 0.059.

For mass walls with insulation installed on the exterior side of the wall:

- Climate Zones 1–15
  - Minimum R-8 continuous insulation, or maximum *U*-factor of 0.125.
- Climate Zone 16
  - Minimum R-13 continuous insulation, or maximum *U*-factor of 0.077.

It's important to note that these mandatory wall insulation requirements are for portions of walls that are above grade, not below.

# 150.0(d)
## Raised Floor Insulation

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** This change clarifies how wood frame assemblies can demonstrate *U*-factor compliance.

**2019 CODE:**

(d) **Raised-floor Insulation.** Raised floors separating conditioned space from unconditioned space or ambient air shall have an overall assembly *U*-factor not exceeding U-0.037. ~~or~~ In a wood framed assembly, compliance with the U-factor may be demonstrated by installing insulation with an ~~installed~~ *R*-value of 19 or greater ~~in a wood framed assembly~~.

**EXCEPTION to Section 150.0(d):** A building with a controlled ventilation or unvented crawl space may omit raised floor insulation if all of the following are met:

A. The foundation walls are insulated to meet the wall insulation minimums as shown in TABLE 150.1-A or B; and

B. A Class I or Class II vapor retarder is placed over the entire floor of the crawl space; and

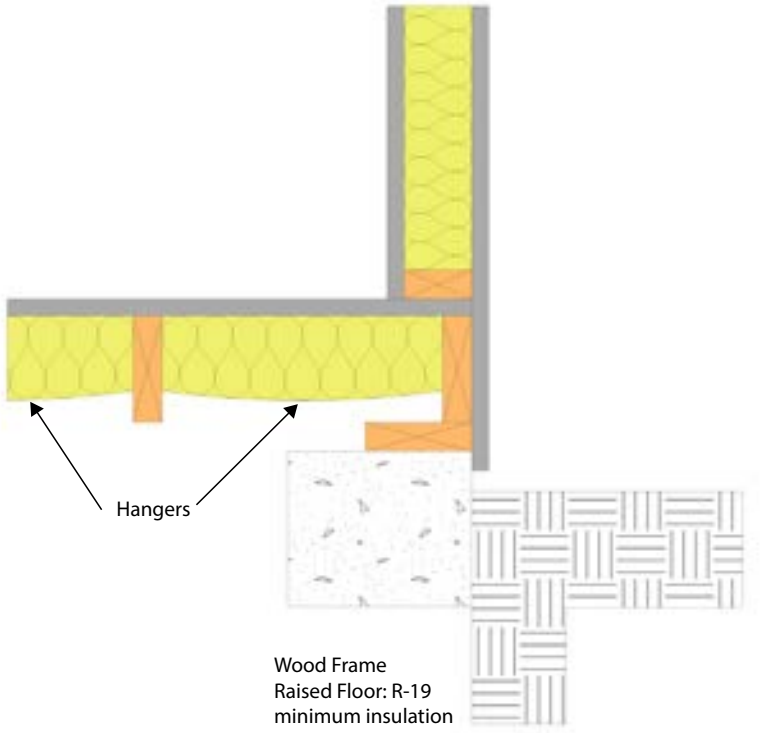
C. Vents between the crawl space and outside air are fitted with automatically operated louvers that are temperature actuated; and

D. The requirements in Reference Residential Appendix RA4.5.1.

**CHANGE SIGNIFICANCE:** The first change to this section clarifies that wood-framed assemblies may have installed insulation with an *R*-value of 19 or greater between framing members. This is equivalent to the *U*-factor specification.

The second change updates the exception to Section 150.0(d). The 2019 Energy Code has separated the prescriptive compliance requirements for single-family and multifamily residential buildings. Table 150.1-B spells out the prescriptive requirements for multifamily buildings.

Note: Unheated concrete raised-floors do not have a mandatory insulation requirement, but do have prescriptive *U*-factor requirements that vary by climate zone. Heated slab floors must meet the mandatory insulation requirements of Section 110.8(g).




Raised Floor Insulation – R-19 is the mandatory minimum insulation requirement for wood-framed raised floors. Alternatively, a maximum assembly *U*-factor of 0.037 satisfies the mandatory insulation requirement of Section 150.0(d). In this illustration, hangers are used to hold insulation in place.
Source: California Energy Commission, 2019 Residential Compliance Manual

# 150.0(e)

## Installation of Fireplaces, Decorative Gas Appliances, and Gas Logs

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Fireplace pilot light and venting requirements were deleted from this section because they are duplicated in Section 110.5 of the Energy Code, and in Section 4.503 of the CALGreen Code.

**2019 CODE:**

(e) **Installation of Fireplaces, Decorative Gas Appliances and Gas Logs.**

~~1.~~ If a masonry or factory-built fireplace is installed, it shall comply with Section 110.5, Section 4.503 of Part 11, and shall have the following:

~~A~~1. Closeable metal or glass doors covering the entire opening of the firebox; and

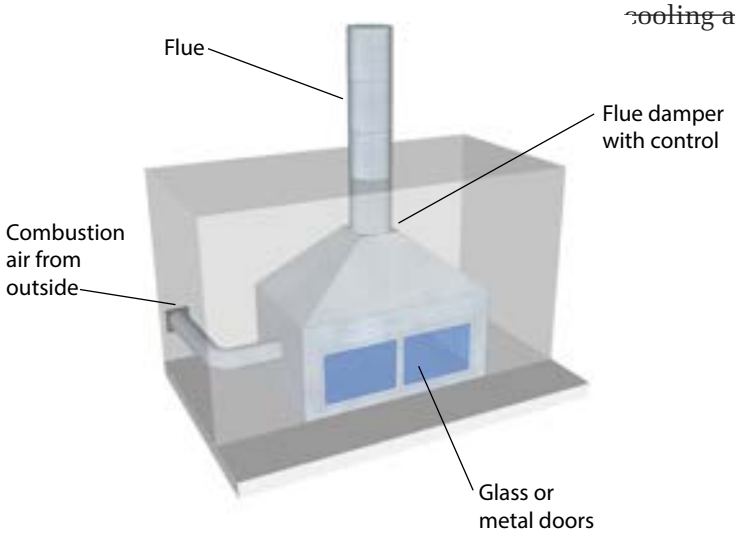
~~B~~2. A combustion air intake to draw air from the outside of the building, which is at least 6 square inches in area and is equipped with a readily accessible, operable, and tight-fitting damper or combustion-air control device; and

**EXCEPTION to Section 150.0(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~~3. A flue damper with a readily accessible control.

**EXCEPTION to Section 150.0(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.~~




Gas Fireplace – The *CALGreen Code* requires that gas fireplaces be direct-vent sealed combustion type. The Energy Code also requires that these fireplaces have closeable metal or glass doors.
Source: California Energy Commission, 2016 Residential Compliance Manual

**CHANGE SIGNIFICANCE:** The measures in this section reduce inefficient and unnecessary fuel consumption by masonry and factory-built fireplaces, and gas logs. The changes streamline the Energy Code by striking the redundant requirements that are found in two other code sections.

Section 4.503 of the *CALGreen Code* states "any installed gas fireplace shall be a direct-vent sealed combustion type." This health-related requirement limits infiltration and harmful emissions associated with gas fireplaces and decorative gas appliances. Due to advances in fireplace technology, the "direct-vent sealed-combustion" design has improved safety and convenience. Reduced infiltration and air leakage are benefits when the fireplace is not operating; which is the majority of the time in most homes.

# 150.0(j)2

## Insulation for Piping and Tanks, Water Piping, Solar Water-heating System Piping, and Space Conditioning System Line Insulation Thickness and Conductivity

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Pipe insulation requirements for certain pipes of solar hot water heating systems were added, and references to the Plumbing Code and Section 120.3(c) of the Energy Code were added to simplify language and create consistency.

**2019 CODE:**

(j) **~~Water System Piping and~~ Insulation for Piping~~,~~ and Tanks, ~~and Cooling System Lines~~.**

[…]

2. **Water piping, solar water-heating system piping, and ~~cool-~~ing space conditioning system line insulation thickness and conductivity.** Piping shall be insulated ~~to the thicknesses~~ as follows:

   A. All domestic hot water piping shall be insulated as specified in Section 609.11 of the *California Plumbing Code*. In addition, the following piping conditions shall have a minimum insulation wall thickness of 1 inch or a minimum insulation R-value of 7.7:~~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 hot water piping with a nominal diameter ~~of~~ equal to or greater than $^{3}/_{4}$ inch (19 millimeter) ~~or larger~~and less than 1 inch.

      iii. All hot water piping with a nominal diameter less than $^{3}/_{4}$ inch that is:

         a. ~~a~~Associated with a domestic hot water recirculation system; ~~regardless of the pipe diameter~~

         b. From the heating source to the kitchen fixtures~~.~~;

         c. From the heating source to a storage tank or between storage tanks; or

         d. Buried below grade.

      ~~iv. Piping from the heating source to storage tank or between tanks.~~

      ~~v. Piping buried below grade.~~

      ~~vi. All hot water pipes from the heating source to the kitchen fixtures.~~

   ~~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.~~

B.~~C.~~ Pipinge for ~~cooling~~space conditioning systems ~~lines~~, solar water-heating system collector loop, and ~~shall be insulated as specified in Subsection A. D~~distribution piping for steam and hydronic heating systems, shall meet the requirements ~~in~~ of Section 120.3(c).~~TABLE 120.3-A.~~

**EXCEPTION 1 to Section 150.0(j)2:** Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

~~**EXCEPTION 2 to Section 150.0(j)2:** Piping that serves process loads, gas piping, cold domestic water piping, condensate drains, roof drains, vents, or waste piping.~~

**EXCEPTION ~~3~~ 2 to Section 150.0(j)2:** Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. ~~Metal p~~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~~ 3 to Section 150.0(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 Quality Insulation Installation (QII) as specified in the Reference Residential Appendix RA3.5.

**EXCEPTION ~~5~~ 4 to Section 150.0(j)2:** Piping ~~installed~~ surrounded with a minimum of 1 inch of~~in attics~~ wall insulation, 2 inches of crawl space insulation, or 4 inches of attic insulation, ~~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 particular water heating recirculation systems, piping insulation requirements are those specified in the approved calculation method.~~

**CHANGE SIGNIFICANCE:** Section 150.0(j)2A – The changes to this section require compliance with Section 609.11 of the Plumbing Code. Section 609.11 of the Plumbing Code requires minimum insulation for all hot water piping based on pipe thickness. The changes also require additional insulation or wall thickness requirements, and includes an R-value reference for compliance convenience.

Section 150.0(j)2Ai – The insulation requirements of this section now only apply to the first 5 feet of cold-water piping from the water storage tank.

Sections 150.0(j)2Aii and iii – These changes address several types of hot water pipes that are less than 1 inch in diameter.

Section 150.0(j)2B and C – These changes standardize insulation protection requirements between residential and nonresidential piping, and simplify the requirements by referencing a single Section 120.3(c) for all requirements. Section 150.0(j)2B formerly required a noncrushable casing or sleeve for buried hot water piping. That requirement has moved to

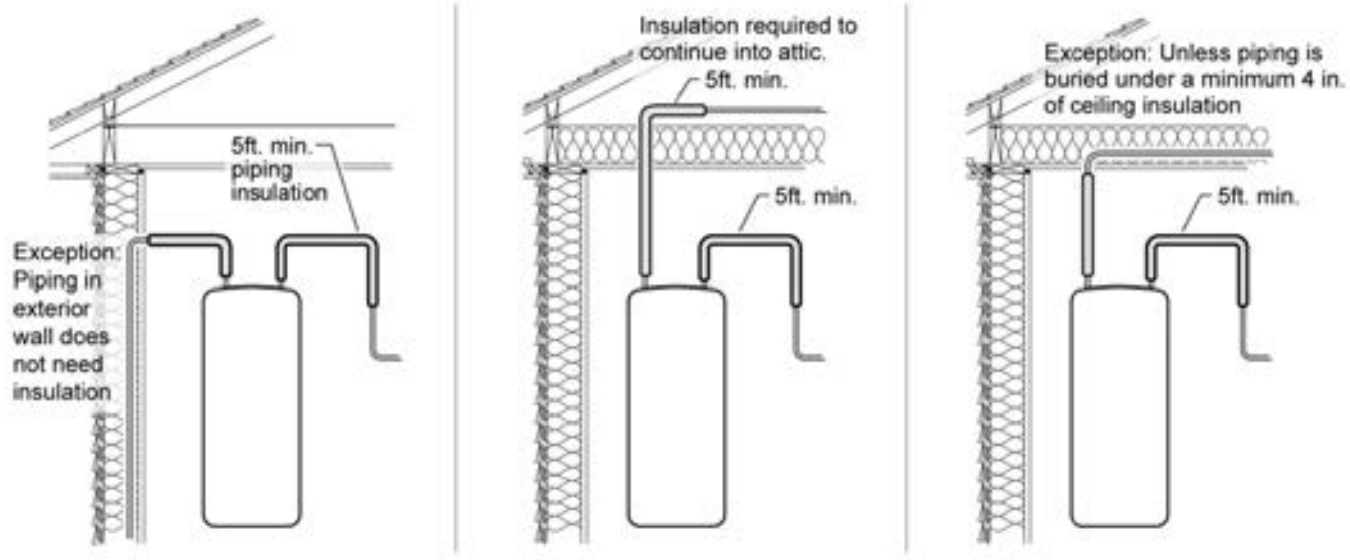
Section 120.3(c). Additionally, the change in Section 150.0(j)2B clarifies that insulation requirements for solar system piping are identical to those for traditional water heating systems.

The term "space conditioning systems" replaces "cooling systems" to clarify that heat pumps performing space heating are also subject to Section 120.3(c). Refrigerant line insulation is required for heat pumps operating exclusively in a heating mode. The requirements are identical to those for heat pumps that operate in both heating and cooling modes.

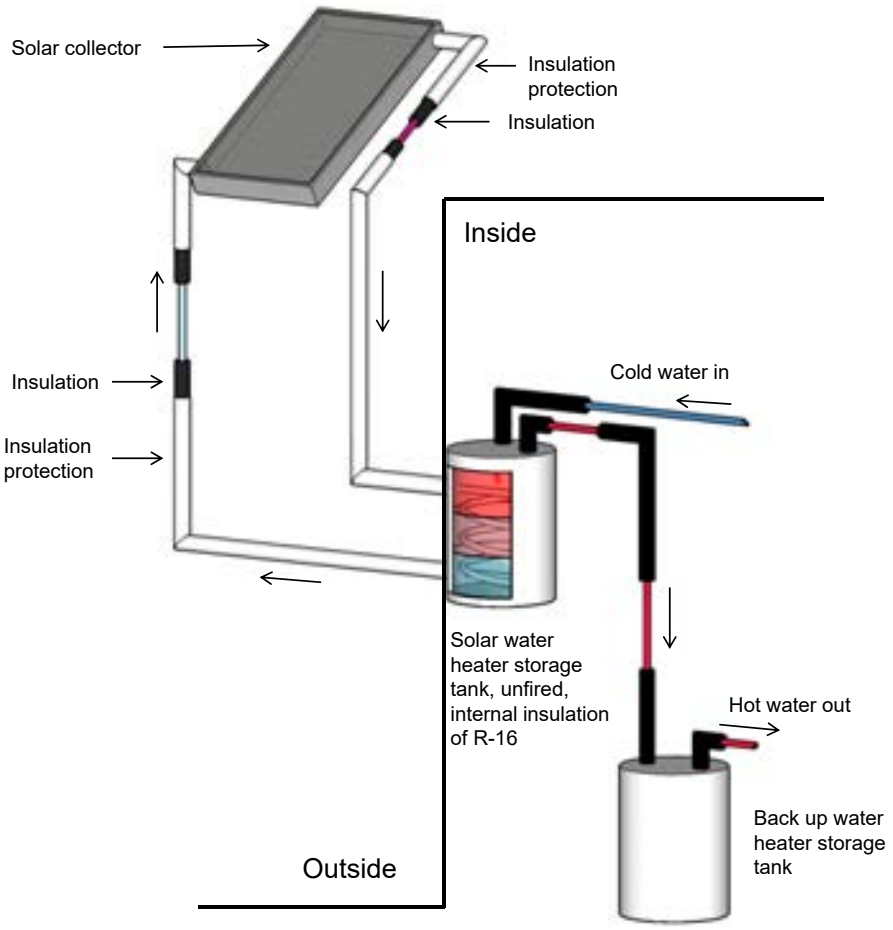
Exception 2 to Section 150.0(j)2–This exception was removed as it was a redundant exception. This section already states the types of piping to which it applies. It also clarifies the prior language that listed specific types of piping that were not covered by this code section.

Exception 5 to Section 150.0(j)5–This change clarifies when cavity insulation can be considered to provide the same benefit as other pipe insulation requirements. The change reduces the amount of insulation required to meet this exception. It also expands the application to crawl-space and wall insulation, as well as to attic insulation.

The "note" in Section 150.0(j) has been deleted to reduce confusion. It did not possess regulatory effect.




Pipe Insulation – Pipes embedded in insulation in walls, and piping in ceilings where buried under at least 4 inches of insulation, are not required to be insulated.
Source: California Energy Commission, 2019 Residential Compliance Manual




Solar Water Heating System – The solar water heating collector loop (illustrated on the left, or "outside" area) must be insulated under the 2019 Energy Code. This insulation must also be protected from damage due to sunlight, moisture, equipment maintenance, and wind, where applicable, per Sections 150.0(j)3 and 120.3(b) of the Energy Code.

Source: Hamed Amouzgar, California Energy Commission, Blueprint Newsletter – Issue 121

# 150.0(j)3

## Insulation for Piping and Tanks, Insulation Protection

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** The requirements for protecting pipe insulation have been moved to Section 120.3(b).

**2019 CODE:**

(j) **~~Water System Piping and~~ Insulation for Piping~~,~~ and Tanks~~, and Cooling System Lines~~.**

[…]

3. **Insulation Protection.** Pipe insulation shall meet the insulation protection requirements of Section 120.3(b).~~Insulation outside conditioned space shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind. Protection includes but is not limited to the following:~~

   ~~A. Insulation exposed to weather shall be installed with a cover suitable for outdoor service, including but not limited to aluminum, sheet metal, painted canvas, or plastic cover. The cover shall be 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 Class I or Class II vapor retarder.~~

**CHANGE SIGNIFICANCE:** This change simplifies the Energy Code by standardizing insulation protection requirements between residential and nonresidential buildings. By referencing Section 120.3(b), it moves low-rise residential piping insulation protection requirements into the section of mandatory requirements for nonresidential, high-rise residential and hotel/motel buildings.

Section 120.3(b) addresses conditions that damage pipe insulation, and allowable ways to protect the insulation. If hot water piping insulation is exposed to weather, it must be protected from physical damage, UV deterioration, and moisture. It also prohibits adhesive tape as an insulation cover because removing the tape will damage the integrity of the original insulation during preventive maintenance.

Pipe Insulation Protection – Insulation must be protected from damage due to sunlight, moisture, equipment maintenance, and wind, according to Section 120.3(b) of the Energy Code.
Source: Airex Manufacturing, Inc.

# 150.0(k)1

## Residential Lighting, Luminaire Requirements

**CHANGE TYPE:** Clarification, Modification, and Addition

**CHANGE SUMMARY:** Changes were made for clarity, to modify, and add expectations for specific light applications.

**2019 CODE:**

(k) **Residential Lighting.**

1. **Luminaire Requirements.**

A. **Luminaire Efficacy.:** All installed luminaires shall meet the requirements~~be high-efficacy~~ in ~~accordance with~~ TABLE 150.0-A.

[…]

C. **Recessed Downlight Luminaires in Ceilings.** In addition to complying with 150.0(k)1A, luminaires recessed into ceilings shall meet all of the following requirements:

[…]

v. Shall not contain screw base sockets.~~; and~~

~~vi. Shall contain light sources that comply with References Joint Appendix JA8, including the elevated temperature requirements, and that are marked "JA8-2016-E" as specified in Reference Joint Appendix JA8~~.

D. **Electronic Ballasts for Fluorescent Lamps.** Ballasts for fluorescent lamps rated 13 watts or greater shall be electronic and shall have an output frequency no less than 20 kHz.

E. **Night Lights, Step Lights and Path Lights.** ~~Permanently installed night lights and night lights integral to installed luminaires or exhaust fans shall be rated to consume no more than five watts of power per luminaire or exhaust fan as determined in accordance with Section 130.0(c).~~ Night lights, step lights and path lights shall not be required to comply with Table 150.0-A or be controlled by vacancy sensors provided they are rated to consume no more than 5 watts of power and emit no more than 150 lumens.

[…]

G. **Screw based luminaires.** Screw based luminaires shall ~~meet all of the following requirements:~~

~~i. The luminaires shall not be recessed downlight luminaires in ceilings; and~~

~~ii. The luminaires shall~~ contain lamps that comply with Reference Joint Appendix JA8; ~~and~~

~~iii. The installed lamps shall be marked with "JA8-2016" or "JA8-2016-E" as specified in Reference Joint Appendix JA8~~.

**EXCEPTION to Section 150.0(k)1G:** Luminaires with hard-wired ballasts for high intensity discharge lamps.

H. **Light Sources in Enclosed or Recessed Luminaires.** Lamps and other separable light sources that are not compliant with the JA8 elevated temperature requirements, including

marked~~ed~~ing requirements, ~~"JA8-2016-E"~~ shall not be installed in enclosed or recessed luminaires.

I. **Light Sources in Drawers, Cabinets, and Linen Closets.** Light sources internal to drawers, cabinetry or linen closets shall not be required to comply with Table 150.0-A or be controlled by vacancy sensors provided that they are rated to consume no more than 5 watts of power and emit no more than 150 lumens, and are equipped with controls that automatically turn the lighting off when the drawer, cabinet or linen closet is closed.

**CHANGE SIGNIFICANCE:** Section 150.0(k)1A – Unnecessary terms were removed from this section for clarity. This change does not materially alter the requirements of the Energy Code.

Section 150.0(k)1C – This change removed 2016 Code language that required all light sources in recessed downlight applications to comply with the elevated temperature requirements of Reference Joint Appendix JA8 (JA8). This was not intended to apply to inseparable light sources, and thus has been removed. Language in Section 150.0(k)1H has been modified to address when these light sources are required to comply with the elevated temperature requirements. Only separable light sources are subject to elevated temperature requirements.

Section 150.0(k)1D – "Fluorescent Lamps" was added to the title of this section to clarify that the electronic ballast requirements are intended for these lamp types. This does not materially change the requirements of the Energy Code.

Section 150.0(k)1E – Step lights and path lights have been added to the scope of this section. Duplicative language has been removed for clarity. New language excludes night lights, step lights, and path lights, from the high efficacy (and JA8) requirements of Table 150.0-A, and from the vacancy control requirements if they meet the following criteria:

1. Are rated to consume no more than 5 watts of power, and
2. Emit no more than 150 lumens.

Note that both criteria must be met for these light sources to be excluded from the high efficacy (and JA8) requirements of Table 150.0-A, and from the control requirements.

Section 150.0(k)1G – The purpose of the changes to this section is to simplify the Energy Code's language on the requirements for screw based light sources. Previous duplicative language was removed. Language disallowing screw based (separable) light sources from being installed in recessed applications already exists in Section 150.0(k)1H. Language requiring the labeling of screw based light sources already exists in JA8.

Section 150.0(k)1H – The purpose of the changes to this section is to clarify the intent of the elevated temperature requirements for residential light sources. The intent is to only apply the elevated temperature testing and labeling requirements to separable light sources, not inseparable light sources. Separable light sources have shown premature degradation when installed in enclosed and recessed applications, which typically have higher operating temperatures. For this reason, these separable light sources must be tested to show that they can achieve their expected life and performance

under environments with higher temperatures when installed in recessed or enclosed applications. Inseparable light sources, like LED trim kits, are not subject to these elevated temperature requirements.

Section 150.0(k)1I–This section was added to simplify requirements for efficient light sources in drawers, cabinets, and linen closets. New language excludes these from the high efficacy (and JA8) requirements of Table 150.0-A, and from the vacancy control requirements if they meet the following criteria:

1. Are rated to consume no more than 5 watts of power; and
2. Emit no more than 150 lumens; and
3. Are equipped with controls that automatically turn the lighting off when the drawer, cabinet, or linen closet is closed.

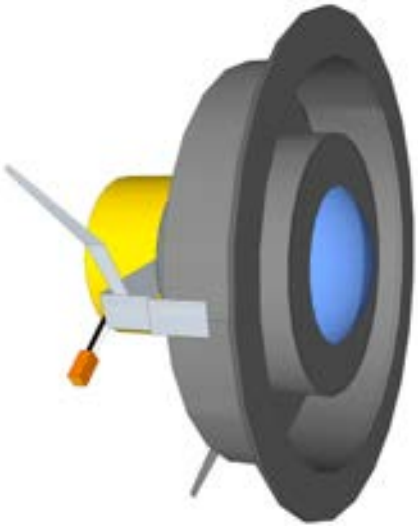
Note that all three criteria must be met for these light sources to be excluded from the high efficacy (and JA8) requirements of Table 150.0-A.

Getty Images

Screw Base LED Light Sources – When used in residential applications, screw base LED light sources must be certified to JA8.
Source: California Energy Commission

Getty Images

Step Lights – Step lights, night lights, and path lights are not subject to JA8 or vacancy sensor control requirements if they consume no more than 5 watts of power and emit no more than 150 lumens



LED Trim Kit – These light sources are considered inseparable and are not subject to the elevated temperature requirements of Section 150.0(k)1H.
Source: Jose Perez, California Energy Commission, Blueprint Newsletter – Issue 122

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** This table was modified to simplify language and increase clarity.

# Table 150.0-A

## Classification of High Efficacy Light Sources

**2019 CODE:**

**TABLE 150.0-A Classification of High Efficacy Light Sources**

| ~~Luminaires installed with only the lighting technologies in this table shall be classified as high efficacy~~ HIGH-EFFICACY LIGHT SOURCES Light sources shall comply with one of the columns below: | |
|---|---|
| Light sources in this column other than those installed in ceiling recessed downlight luminaires are classified as high efficacy and are **not** required to comply with Reference Joint Appendix JA8. | Light sources in this column ~~shall be~~ are only considered to be high efficacy if they are certified to the Commission as High Efficacy Light Sources in accordance with Reference Joint Appendix JA8 and be marked as ~~meeting~~ required by JA8. |
| 1. Pin-based linear fluorescent or compact fluorescent light sources using electronic ballasts.<br>2. Pulse-start metal halide light sources.<br>3. High pressure sodium light sources.<br>~~4. GU-24 sockets containing light sources other than LEDs.~~ [a,b]<br>~~5~~4. Luminaires with hardwired high frequency generator and induction lamp.<br>~~6~~5. ~~Inseparable SSL luminaires that are~~LED light sources installed outdoors.<br>~~7~~6. Inseparable SSL luminaires containing colored light sources that are installed to provide decorative lighting. | 8. All light sources installed in ceiling recessed downlight luminaires. Note that ceiling recessed downlight luminaires shall not have screw bases regardless of lamp type as described in Section 150.0(k)1C.<br>~~9. GU-24 sockets containing LED light sources.~~<br>~~10~~9. Any light source not otherwise listed in this table ~~and certified to the Commission as complying with Joint Appendix 8~~. |

~~Notes:~~
~~a. GU-24 sockets containing light sources such as compact fluorescent lamps and induction lamps.~~
~~b. California Title 20 Section 1605(k)3 does not allow incandescent sources to have a GU-24 base.~~

**CHANGE SIGNIFICANCE:** The purpose of the changes to this table are to do the following:

- Improve phrasing
- Remove redundant phrasing
- Remove obsolete references to GU-24 sockets
- Expand Item 6 to apply to all LED sources and not solely to inseparable luminaires

This change has the substantive effect of allowing outdoor LED lamps to forego JA8 testing and associated requirements, and of requiring GU-24 socketed lighting to be considered identical to all other lighting. These changes are necessary to avoid applying JA8 requirements in situations where they will have negligible benefit, and to remove an inconsistency of treating the same lighting technology differently depending on its socket or connection type.

# 150.0(k)2

## Residential Lighting, Interior Lighting Switching Devices and Controls

**CHANGE TYPE:** Clarification, Modification, and Addition

**CHANGE SUMMARY:** Changes were made for clarity, to modify, and add control requirements for specific light applications.

**2019 CODE:**

(k) **Residential Lighting.**

[…]

2. **Interior Lighting Switching Devices and Controls.**

[…]

B. Exhaust fans shall be ~~switched~~ controlled separately from lighting systems.

**EXCEPTION to Section 150.0(k)2B:** Lighting integral to an exhaust fan may be on the same ~~switch~~ control as the fan provided the lighting can be ~~switched~~ turned OFF in accordance with the applicable provisions in Section 150.0(k)2 while allowing the fan to continue to operate for an extended period of time.

C. ~~Luminaires~~ Lighting shall ~~be switched with~~have readily accessible wall-mounted controls that ~~permit~~ allow the ~~luminaires~~ lighting to be manually ~~switched~~ turned ON and OFF.

**EXCEPTION to Section 150.0(k)2C:** Ceiling fans may provide control of integrated lighting via a remote control.

[…]

E. No controls shall bypass a dimmer, occupant sensor or vacancy sensor function where that dimmer or vacancy sensor has been installed to comply with Section 150.0(k).

[…]

G. An Energy Management Control System (EMCS) may be used to comply with ~~dimmer~~ control requirements in Section 150.0(k) if at a minimum it provides the functionality of ~~a dimmer~~the specified controls in accordance with Section 110.9, meets the installation certificate requirements in Section 130.4, meets the EMCS requirements in Section 130.5~~0~~(~~f~~e), and complies with all other 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 installation certificate requirements in Section 130.4, the EMCS requirements in Section 130.5(f), and complies with all other applicable requirements in Section 150.0(k)2.~~

[…]

~~J~~I. In bathrooms, garages, laundry rooms, and utility rooms, at least one luminaire in each of these spaces shall be controlled

by an occupant or vacancy sensor providing automatic-off functionality. If an occupant sensor is installed, it shall be initially configured to manual-on operation using the manual control required under Section 150.0(k)2C.

~~K~~J. ~~Dimmers or vacancy sensors shall control all luminaires required to have light sources compliant with~~Luminaires that are or contain light sources that meet Reference Joint Appendix JA8 requirements for dimming, and that are not controlled by occupancy or vacancy sensors, shall have dimming controls.

**EXCEPTION 1 to Section 150.0(k)2~~K~~J:** Luminaires in closets less than 70 square feet.

**EXCEPTION 2 to Section 150.0(k)2~~K~~J:** Luminaires in hallways.

~~L~~K. Undercabinet lighting shall be ~~switched~~ controlled separately from ~~other~~ ceiling-installed lighting ~~systems~~ such that one can be turned on without turning on the other.

**CHANGE SIGNIFICANCE:** Section 150.0(k)2B – The purpose of the changes to this section is to remove the unnecessary term "switched." Digital controls do not include "switches," and this language could have been interpreted to disallow digital controls. Also removed was "extended period of time" from the exception to this section. "Extended period of time" is not defined and was removed for simplicity. These changes do not materially alter the requirements of the Energy Code.

Section 150.0(k)2C – Language relating to manual control requirements was reworked for clarity, and to allow different technologies to comply with the Energy Code's requirements without confusion. An exception was also added for ceiling fans with lights that use remote controls to satisfy the control requirements of this section.

Section 150.0(k)2E – The purpose of the change to this section was to add occupancy sensors to the list of controls that shall not have bypasses that override their controls.

Section 150.0(k)2G and H – The purpose of the changes to these sections was to merge G with the 2016 language of H. These changes clarify without materially altering the requirements of the Energy Code.

Section 150.0(k)2I – The changes to this section update its numbering, and allow installing occupancy sensors in these applications as long as they are programed to operate in manual-on mode. Vacancy sensors are, by definition, occupancy sensors that only turn on via manual-on control. An automatic-on occupancy sensor that has been reprogrammed to only turn on via manual-on control satisfies the intent of this section.

Section 150.0(k)2J – This language was restructured for clarity. The intent of this language is to require all JA8 light sources to be controlled by one of the following:

1. An auto-on occupancy sensor; or
2. A (manual-on) vacancy sensor; or
3. A dimmer.

Most residential lighting already has to be on an occupancy or vacancy sensor, so in the event that a JA8 light source is installed and it is not already controlled by one of these controls, it must then be controlled by a dimmer. Ultimately, all indoor general lighting LED light sources must be controlled by one of the 3 controls listed above, except for light sources in closets less than 70 square feet, and light sources in hallways.

Section 150.0(k)2K – The purpose of the changes to this section is to clarify its intent and narrow its scope to the interaction between undercabinet lighting and ceiling-mounted general lighting. This change clarifies without materially altering the requirements of the Energy Code.

# 150.0(k)3

## Residential Lighting, Outdoor Lighting

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** This section was restructured to simplify code language for outdoor lighting.

**2019 CODE:**

(k) **Residential Lighting.**

[…]

3. **Residential Outdoor Lighting.** In addition to meeting the requirements of Section 150.0(k)1A, luminaires providing residential outdoor lighting shall meet the following requirements, as applicable:

A. For single-family residential buildings, outdoor lighting permanently mounted to a residential building~~,~~ or to other buildings on the same lot~~,~~ shall meet the requirement in item i and the requirements in either item ii or item iii:

i. Controlled by a manual ON and OFF switch that ~~does not override to ON~~permits the automatic actions of ~~Items~~ items ii or iii below; and

ii. Controlled by a photocell and either a motion sensor or an automatic time switch control~~. Controls that override to ON shall not be allowed unless the override automatically reactivates the motion sensor within 6 hours~~; or

iii. Controlled by an ~~one of the following methods:~~

~~a. Photocontrol and automatic time switch control. Controls that override to ON shall not be allowed unless the override shall automatically return the photocontrol and automatic time switch control to its normal operation within 6 hours.; or~~

~~b. A~~astronomical time clock control.

Controls that override to ON shall not be allowed unless the override ~~shall~~ automatically returns the ~~astronomical clock to~~automatic control to its normal operation within 6 hours. An ~~and which is programmed to automatically turn the outdoor lighting OFF during daylight hours; or~~

~~c. E~~energy management control system that provides the specified lighting control functionality and complies with all requirements applicable to the specified controls may be used to meet these requirements.~~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 Installation Certification requirements in Section 130.4; does not have an override or bypass switch that allows the luminaire to be always ON; and, is programmed to automatically turn the outdoor lighting OFF during daylight hours.~~

B. For low-rise ~~multifamily~~ residential buildings with four or more dwelling units, 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~~either:

   i. ~~Shall comply with~~ Section 150.0(k)3A; or

   ii. ~~Shall comply with t~~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, any outdoor lighting for residential parking lots or carports with a total of eight or more vehicles per site and any outdoor lighting not regulated by Section 150.0(k)3B ~~or 150.0(k)3D~~ shall comply with the applicable requirements in Sections 110.9, 130.0, 130.2, 130.4, 140.7 and 141.0.

~~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, 130.0, 130.2, 130.4, 140.7 and 141.0~~.

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section is to restructure and simplify code language. The changes to this section do not materially alter the requirements.

# 150.0(k)4

## Residential Lighting, Internally Illuminated Address Signs

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Language for internally illuminated address signs was simplified for clarity.

**2019 CODE:**

(k) **Residential Lighting.**

[…]

4. **Internally illuminated address signs.** Internally illuminated address signs shall either:
   A. Comply with Section 140.8; or
   B. ~~Shall c~~Consume no more than 5 watts of power ~~as determined according to Section 130.0(c)~~.

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section is to simplify phrasing and remove an unnecessary reference to a different section. These changes clarify without materially altering the requirements of the Energy Code.

# 150.0(k)6

## Residential Lighting, Interior Common Areas of Low-rise Multifamily Residential Buildings

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Language relating to lighting in common areas was altered for clarity.

**2019 CODE:**

(k) **Residential Lighting.**

[…]

6. **Interior Common Areas of Low-rise ~~Multi-Family~~Multifamily Residential Buildings.**

   A. In a low-rise multifamily 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~~comply with Table 150.0-A and be controlled by an occupant sensor.

   B. In a low-rise multifamily residential building where the total interior common area in a single building equals more than 20 percent of the floor area, permanently installed lighting for the interior common areas 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 and off from all designed paths of ingress and egress.

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section is to correct punctuation and improve phrasing of the Energy Code. The changes clarify without materially altering the requirements of the Energy Code.

# 150.0(m)1

## Air-Distribution and Ventilation System Ducts, Plenums and Fans; CMC Compliance

**CHANGE TYPE:** Clarification and Addition

**CHANGE SUMMARY:** Two new exceptions address ducts in interior wall cavities (where space for insulation is extremely limited), and ducts that are intentionally directly exposed to the space they are conditioning.

**2019 CODE:**

(m) **Air-Distribution and Ventilation System Ducts, Plenums, and Fans.**

1. **CMC Compliance.**

A. 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 601.0, 602.0, 603.0, 604.0, 605.0 and ANSI/SMACNA-006-2006 HVAC Duct Construction Standards Metal and Flexible, 3rd Edition, incorporated herein by reference.

B. Portions of supply-air and return-air ducts and plenums of a space heating or cooling system shall either be insulated to:

i. a minimum installed level of R-6.0 ~~(or any higher level required by CMC Section 605.0)~~, or

ii. a minimum installed level of R-4.2 when the duct system is located entirely in conditioned space as confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix RA3.1.4.3.8.

**EXCEPTION 1 to Section 150.0(m)1B:** Portions of the duct system located in wall cavities are not required to be insulated if the following conditions are met:

i. The cavity, duct or plenum is located entirely inside the building's thermal envelope as confirmed by visual inspection.

ii. At all locations where portions of non-insulated cavities, ducts, or plenums make a transition into unconditioned space, the transition shall be air-sealed to prevent air infiltration into the cavity and be insulated to a minimum of R-6 as confirmed by visual inspection.

**EXCEPTION 2 to Section 150.0(m)1B:** Portions of the duct system completely exposed and surrounded by directly conditioned space are not required to be insulated.

C. Connections of metal ducts and the inner core of flexible ducts shall be mechanically fastened.

D. 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.

E. Building cavities, support platforms for air handlers, and plenums designed 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 150.0(m)1:** Ducts and fans integral to a wood heater or fireplace.

**CHANGE SIGNIFICANCE:** This section contains requirements for *California Mechanical Code* compliance. For clarity, unnecessary language has been removed and the subsections have been renumbered.

Two exceptions were added to exclude ducts from insulation requirements when inside of interior wall cavities, and for ducts that are directly exposed to the space which they are conditioning. Energy savings are not significantly increased by requiring additional insulation in these scenarios.

Getty Images

Ducts Completely Exposed to Directly Conditioned Space – Portions of ducts that are completely exposed and surrounded by directly conditioned space are not required to be insulated under the 2019 Energy Code.

# 150.0(m)10

## Air-Distribution and Ventilation System Ducts, Plenums, and Fans; Porous Inner Core Flex Duct

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Flexible ducts with porous inner cores are allowed when they have internal insulating features.

**2019 CODE:**

(m) **Air-Distribution and Ventilation System Ducts, Plenums, and Fans.**

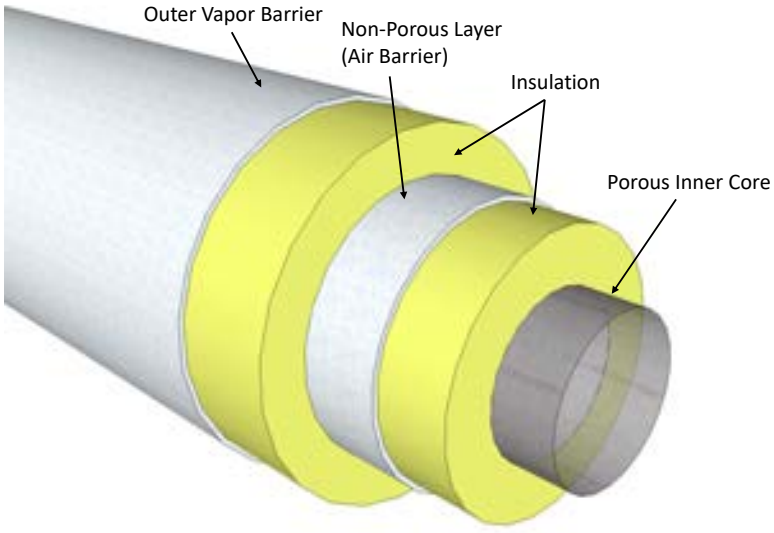
[…]

10. **Porous Inner Core Flex Duct.** Flexible ducts having porous inner cores shall ~~not be used~~have a non-porous layer or air barrier between the inner core and the outer vapor barrier.

**CHANGE SIGNIFICANCE:** This change allows flexible ducts with porous inner cores to be installed if they have an internal air barrier or non-porous layer between the inner core and the outer vapor barrier.

The 2016 Energy Standards prohibited the use of porous inner core flex ducts, without exceptions. The flex duct exclusion was first introduced in the 2005 Energy Code. The prohibition was based on the perception that the outer jacket was the only air barrier. The presence of only one air barrier increases the potential for leakage during installation, and throughout the life of the duct system. To minimize this risk, the prohibition was adopted.

Porous inner core flex ducts are essential for certain HVAC applications — particularly small-duct high-velocity systems. The Energy Commission was asked to determine if porous inner core flex duct, with a non-porous layer between the inner core and outer jacket, complied with Section 150.0(m)10. The Executive Director then issued an interpretation, using his authority under Section 10-107(b). The interpretation concluded that "flexible ducts having a non-porous layer between the porous inner core and the outer vapor barrier satisfies the intent of §150.0(m)10." The determination was published in the Energy Commission's Blueprint Newsletter, Issue #114 (May – June 2016), and then added to the 2019 Energy Code.




Porous Inner Core Flex Duct – Flexible ducts having a non-porous layer between the porous inner core and the outer vapor barrier satisfy the intent of Section 150.0(m)10 and can be used for compliance with the Energy Code.
Source: Jose Perez, California Energy Commission, Blueprint Newsletter – Issue 114

# 150.0(m)12

## Air-Distribution and Ventilation System Ducts, Plenums, and Fans; Air Filtration

**CHANGE TYPE:** Modifications

**CHANGE SUMMARY:** Ventilation system requirements were modified to address concerns about indoor air quality and performance efficiency.

**2019 CODE:**

(m) **Air-Distribution and Ventilation System Ducts, Plenums, and Fans.**

12. **Air Filtration.**

A. System types specified in subsections i, ii, and iii shall be provided with air filters in accordance with Sections 150.0(m)12B, 150.0(m)12C, and 150.0(m)12D. System types specified in subsection i shall also comply with Section 150.0(m)12E.

i. Mechanical space conditioning 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 be provided with air filter devices in accordance with the following~~:

ii. Mechanical supply-only ventilation systems that provide outside air to an occupiable space.

iii. The supply side of mechanical balanced ventilation systems, including heat recovery ventilation systems, and energy recovery ventilation systems that provide outside air to an occupiable space.

**EXCEPTION 1 to Section 150.0(m)12A:** Evaporative coolers are exempt from the air filtration requirements in Section 150.0(m)12.

~~A~~B. **System Design and Installation.**

i. The system shall be designed to ensure that all recirculated air and all outdoor air supplied to the occupiable space is filtered before passing through ~~the~~ any system's thermal conditioning components.

**EXCEPTION 1 to Section 150.0(m)12Bi:** For heat recovery ventilators and energy recovery ventilators the location of the filters required by Section 150.0(m)12 may be downstream of a system thermal conditioning component, provided the system is equipped with ancillary filtration upstream of the system's thermal conditioning component.

ii. ~~The~~ All systems shall be designed to accommodate the clean-filter pressure drop imposed by the system air filter ~~device~~(s). The design airflow rate, and maximum allowable clean-filter pressure drop at the design airflow rate applicable to each air filter device shall be determined and reported on labels according to subsection iv below.

Systems specified in Section 150.0(m)12Ai shall be equipped with air filters that meet either subsection a or b below.

a. Nominal two-inch minimum depth filter(s) shall be sized by the system designer, or

b. Nominal one-inch minimum depth filter(s) shall be allowed if the filter(s) are sized according to Equation 150.0-A, based on a maximum face velocity of 150 ft per minute, and according to the maximum allowable clean-filter pressure drop specified in Section 150.0(m)12Dii.

$A_{face} = Q_{filter} / V_{face}$ **(Equation 150.0-A)**

where

$A_{face}$ = air filter face area, the product of air filter nominal length × nominal width, $ft^2$

$Q_{filter}$ = design airflow rate for the air filter, $ft^3$/min

$V_{face}$ = air filter face velocity ≤ 150, ft/min

iii. All system air filters ~~devices~~ shall be located and installed in such a manner as to be accessible for~~allow access and~~ regular service by the system owner.

iv. All system air filter ~~device~~ installation locations shall be labeled to disclose the applicable design airflow rate and the maximum allowable clean-filter pressure drop ~~as determined according to subsection ii above~~. The labels shall be permanently affixed to the air filter ~~device~~installation location, readily legible, and visible to a person replacing the air filter ~~media~~.

~~B~~C. **Air Filter ~~Media~~ Efficiency.** The system shall be provided with air filter(s) ~~media~~ having a designated efficiency equal to or greater than MERV 6 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30-1.0 µm range, and equal to or greater than 85 percent in the 1.0-3.0 µm range ~~3.0–10 µm range~~ when tested in accordance with AHRI Standard 680.

~~C~~D. **Air Filter ~~Media~~ Pressure Drop.** ~~The~~ All systems shall be provided with air-filter(s) ~~media~~ that conforms to the applicable maximum allowable clean-filter pressure drop specified in subsections i, ii, iii, or iv below ~~determined according to Section 150.0(m)12Aii~~, when tested using ASHRAE Standard 52.2, or as rated using AHRI Standard 680, for the applicable design airflow rates for the system air filter(s) devices.

i. The maximum allowable clean-filter pressure drop determined by the system design for the nominal two-inch minimum depth air filter required by Section 150.0(m)12Biia, or

ii. A maximum of 25 PA (0.1 inches water) clean-filter pressure drop shall be allowed for a nominal one-inch depth air filter sized according to Section 150.0(m)12Biib, or

iii. For systems specified in 150.0(m)12Aii, and 150.0(m)12Aiii, the maximum allowable clean filter pressure drop determined by the system design.

iv. If ~~the alternative~~ EXCEPTION 1 to Section 150.0(m)13B or D is utilized for compliance with cooling system airflow rate and fan efficacy requirements, the ~~design~~ clean-filter pressure drop for the system air filter ~~media~~ shall conform to the requirements given in TABLE 150.0-B or 150.0-C.

~~D~~E. **Air Filter ~~Media~~ Product Labeling.** ~~The system~~Systems described in 150.0(m)12Ai shall be equipped~~provided~~ with air filters ~~media~~ that have ~~has~~ been labeled by the manufacturer to disclose the efficiency and pressure drop ratings that demonstrate conformance with Sections 150.0(m)12C~~B~~ and 150.0(m)12D~~C~~.

[…]

**TABLE 150.0-B Return Duct Sizing for Single Return Duct Systems**

Return duct length shall not exceed 30 feet and shall contain no more than 180° of bend. If the total bending exceeds 90°, on bend shall be a metal elbow.

Return grill devices shall be labeled in accordance with the requirements in Section 150.0(m)12Biv~~A~~ to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of ~~12.5~~25 Pa (~~0.05~~0.1 inches water) for the air filter ~~media~~ when tested using ASHRAE Standard 52.2, or as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.

| System Nominal Cooling Capacity (Ton)* | Return Duct Minimum Nominal ~~Return Duct~~ Diameter (inch) | Minimum Total Return Filter Grille ~~Gross~~ Nominal Area (inch$^2$) |
|---|---|---|
| 1.5 | 16 | 500 |
| 2.0 | 18 | 600 |
| 2.5 | 20 | 800 |

*Not applicable to systems with nominal cooling capacity greater than 2.5 tons or less than 1.5 ton.

**TABLE 150.0-C Return Duct Sizing for Multiple Return Duct Systems**

Each return duct length shall not exceed 30 feet and shall contain no more than 180° of bend. If the total bending exceeds 90°, one bend shall be a metal elbow.

Return grille devices shall be labeled in accordance with the requirements in Section 150.0(m)12Biv~~A~~ to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of 25 Pa (~~0.05~~0.1 inches water) for the air filter when tested using ASHRAE Standard 52.2, or media as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.

| System Nominal Cooling Capacity (Ton)* | Return Duct 1 Minimum Nominal Diameter (inch) | Return Duct 2 Minimum Nominal Diameter (inch) | Minimum Total Return Filter Grille ~~Gross~~ Nominal Area (inch$^2$) |
|---|---|---|---|
| 1.5 | 12 | 10 | 500 |
| 2.0 | 14 | 12 | 600 |
| 2.5 | 14 | 14 | 800 |
| 3.0 | 16 | 14 | 900 |
| 3.5 | 16 | 16 | 1000 |
| 4.0 | 18 | 18 | 1200 |
| 5.0 | 20 | 20 | 1500 |

*Not applicable to systems with nominal cooling capacity greater than 5.0 tons or less than 1.5 tons.

**CHANGE SIGNIFICANCE:** The term space conditioning systems was added to clarify that systems with thermal conditioning components are subject to Section 150.0(m)12 requirements. New numbering and nonsubstantive edits were added to improve clarity, and an exception for evaporative coolers was moved to the end of section A for clarity.

This section now requires increased air filtration (Minimum Efficiency Reporting Value (MERV) 13 rated filter), and specifies 2-inch depth filters, but allows 1-inch depth filters when the system design meets Energy Code specifications. The 2019 Energy Code was developed considering new information about the effects of indoor particulate pollutants. Filters meeting the 2016 Energy Code's MERV 6 requirements are only moderately effective at filtering out airborne particulates (PM10), and are unable to capture or filter out fine particulates (PM2.5).

Most regions of California do not meet healthy outdoor air requirements for fine and ultra-fine particles. The particulates are brought into the home by ventilation, creating a feedback loop that substantially increases the amount of ventilation needed to improve indoor concentrations of PM10 and PM2.5. Increasing filtration is more energy efficient than increasing ventilation rates. A MERV 13 filter, when compared to a MERV 6 rated filter, effectively filters out PM2.5 with a negligible effect on pressure drop.

In addition to the filtration requirements for ducted space conditioning systems, two ventilation system types now must also meet air filtration requirements: (1) supply-only ventilation systems, and (2) the supply side of balanced ventilation systems.

There are significant relationships and interactions between building insulation and air tightness requirements, ventilation requirements, and indoor air quality. The Energy Commission is directed in statute to consider the impacts of building standards on indoor air pollution problems. By considering energy efficiency measures alone, indoor air quality could be impacted. Indoor air quality should not be addressed alone because some approaches to indoor air quality can waste energy. Federal and State law directs the Energy Commission to either directly incorporate or to exceed requirements in national model energy codes (such as ASHRAE 62.1, 62.2, and 90.1), and all nationally recognized model codes that address both energy efficiency and indoor air quality.

Increasing ventilation rates increase energy use, due to increased fan use and loss of conditioned air. Increased filtration has a negligible impact on the performance of HVAC equipment, with no loss of conditioned air.

The 2019 Energy Code also ensures that HVAC systems can accommodate above-code MERV filters. Occupants can improve filtration without inadvertently harming their system's energy efficiency, lifespan, or overall performance. When occupants install higher-MERV filters, they can potentially increase system pressure drop and reduce system energy efficiency. While some 1-inch MERV 13 filters have pressure drop comparable to 1-inch MERV 6 filters, this is not true for all MERV 13 or higher filters. Filters with greater surface area specifically address pressure drop. By increasing filter depth and number of pleats, the total surface area is increased and the effects on system pressure is decreased. Compliant filters with a two-inch depth are widely available to consumers.

The purpose of the changes to Table 150.0-B and Table 150.0-C is to add a reference to ASHRAE 52.2 to mirror the same specification that is referenced in Section 150.0(m)12D. A reference was also updated to 150.0(m)12iv to reflect the updated location for the same information previously referenced. The clean filter pressure drop specification has been relaxed from 0.05 to 0.1 inch water which is a more attainable value according to newly published performance information made available due to the Title 20 air filter label requirements. The change is necessary to ensure that compliance with the clean pressure drop specification regulation is reasonably attainable using current commercially available air filter stock.

Other modifications were made to headers for grammar, and to clarify that values in the table are nominal values.

# 150.0(m)13B

## Air-Distribution and Ventilation System Ducts, Plenums, and Fans; Single Zone Central Forced Air Systems; Airflow Rate and Fan Efficacy

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** The changes establish new fan efficacy and airflow rates for single zone central forced air systems.

**2019 CODE:**

(m) **Air-Distribution and Ventilation System Ducts, Plenums, and Fans.**

[…]

13. ~~**Duct**~~ **Space Conditioning System** ~~**Sizing and**~~ **Airflow Rate and Fan Efficacy**~~**Filter Grille Sizing.**~~ Space conditioning systems that utilize forced air ducts to supply cooling to an occupiable space shall:

[…]

B. **Single Zone Central Forced Air Systems.** Demonstrate, in every control mode, airflow greater than or equal to 350 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to the maximum W/CFM specified in subsections i or ii below. The airflow rate and fan efficacy requirements in this section shall be confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.

i. ~~0.58~~0.45 W/CFM for gas furnace air-handling units.

ii. 0.58 W/CFM for air-handling units that are not gas furnaces.

~~as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.~~

[…]

**EXCEPTION 1 to Section 150.0(m)13B and D:** Standard ducted systems (without zoning dampers) may comply by meeting the applicable requirements in TABLE 150.0-B or 150.0-C 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 specified by ~~of~~ Section 150.0(m)12Div~~C~~ for the system air filter ~~device~~(s) shall conform to the requirements given in TABLES 150.0-B and 150.0-C.

**EXCEPTION 2 to Section 150.0(m)13B and D:** Multispeed compressor systems or variable speed compressor systems shall verify air flow (cfm/ton) and fan efficacy (Watt/cfm) for system operation at the maximum compressor speed and the maximum air handler fan speed.

**EXCEPTION 3 to Section 150.0(m)13B:** Gas furnace air-handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value 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 3 to Section 150.0(m)13B:~~** ~~The Executive Director may approve alternate airflow and fan efficacy requirements for small duct high velocity systems.~~

**CHANGE SIGNIFICANCE:** The new and modified requirements for single zone gas furnace air handlers establish a more stringent efficiency requirement. This new efficiency requirement was found to be achievable because of more stringent fan requirements for residential gas furnaces at the federal level. Gas furnace air handling units can feasibly and cost effectively achieve a maximum 0.45 watts per CFM fan efficacy, an improvement on the prior requirement. The changes also clarify the application of field verification requirements.

Exception 1 to Section 150.0(m)13B – This exception incorporates alternate airflow and fan efficacy requirements for Small Duct High Velocity (SDHV) forced air systems. These new targets are achievable by all certified SDHV air conditioners and heat pump combinations. These changes ensure SDHV systems can be installed in California and the efficiency requirements are appropriate for the unique features of this equipment.

Exception 3 to Section 150.0(m)13B of the 2016 Energy Code is no longer needed because of the new SDHV requirements and has been deleted.

The new Exception 3 to Section 150.0(m)13B directly addresses enforcement. Compliance is not based on the date that a building permit is issued. The exception references the date of manufacture of the equipment, due to federal fan requirements. The change prevents this requirement from unintentionally creating stranded inventory.

# 150.0(m)13C

## Air-Distribution and Ventilation System Ducts, Plenums, and Fans; Space Conditioning System Airflow Rate and Fan Efficacy; Zonally Controlled Central Forced Air Systems

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** The changes establish a more stringent efficiency requirement for gas furnace air-handling units and clarify field verification requirements.

**2019 CODE:**

(m) **Air-Distribution and Ventilation System Ducts, Plenums, and Fans.**

[…]

13. ~~**Duct**~~ **Space Conditioning System** ~~**Sizing**~~ **and Air**~~**Filter Grille Sizing**~~**flow Rate and Fan Efficacy.** Space conditioning systems that utilize forced air ducts to supply cooling to an occupiable space shall:

[…]

C. **Zonally Controlled Central Forced Air Systems.** Zonally controlled central forced air cooling systems shall be capable of simultaneously delivering, in every zonal control mode, an airflow from the dwelling, through the air handler fan and delivered to the dwelling, of greater than or equal to ~~350 CFM per ton of nominal cooling capacity, and operating at an air-handling unit fan efficacy of less than or equal to~~ the maximum W/CFM specified in subsections i or ii below. The airflow rate and fan efficacy requirements in this section shall be confirmed by field verification and diagnostic testing in accordance with the applicable procedures specified in Reference Residential Appendix RA3.3.

i. 0.45 W/CFM for gas furnace air-handling units.

ii. 0.58 W/CFM for air-handling units that are not gas furnaces.

~~as confirmed by field verification and diagnostic testing in accordance with the applicable procedures specified in Reference Residential Appendix RA3.3.~~

[…]

**EXCEPTION 2 to Section 150.0(m)13C:** Gas furnace air-handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value 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.

**CHANGE SIGNIFICANCE:** These changes to the zonally controlled central forced air system requirements establish a more stringent efficiency requirement for gas furnace air-handling units, and clarify the

application of field verification requirements. Gas furnace air-handling units can feasibly and cost effectively achieve a 0.45 watts per CFM fan efficacy. The specification for nongas units is 0.58 watts per CFM. Field verification and diagnostic procedures are performed by a HERS rater and are specified in Reference Residential Appendix RA3.3.

Exception 2 to Section 150.0(m)13C directly addresses enforcement. Fan efficacy rates are not based on the date that a building permit is issued. The exception references the date of manufacture of the equipment due to federal fan requirements. The change prevents this requirement from unintentionally creating stranded inventory.

# 150.0(m)13D

## Air-Distribution and Ventilation System Ducts, Plenums, and Fans; Space Conditioning System Airflow Rate and Fan Efficacy; Small Duct High Velocity Forced Air Systems

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** New airflow and fan efficacy requirements specifically address the capabilities of Small Duct High Velocity (SDHV) forced air systems.

**2019 CODE:**

(m) **Air-Distribution and Ventilation System Ducts, Plenums, and Fans.**

[…]

13. **~~Duct~~ Space Conditioning System ~~Sizing~~ and Airflow Rate and Fan Efficacy~~Filter Grille Sizing~~.** Space conditioning systems that utilize forced air ducts to supply cooling to an occupiable space shall:

[…]

D. **Small Duct High Velocity Forced Air Systems.** Demonstrate, in every control mode, airflow greater than or equal to 250 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to 0.62 W/CFM as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3

**EXCEPTION 1 to Section 150.0(m)13B and D:** Standard ducted systems (without zoning dampers) may comply by meeting the applicable requirements in Table 150.0-B or 150.0-C 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 specified by ~~of~~ Section 150.0(m)12Div~~C~~ for the system air filter ~~device~~(s) shall conform to the requirements given in Tables 150.0-B and 150.0-C.

**EXCEPTION 2 to Section 150.0(m)13B and D:** Multi-speed compressor systems or variable speed compressor systems shall verify air flow (cfm/ton) and fan efficacy (Watt/cfm) for system operation at the maximum compressor speed and the maximum air handler fan speed.

**CHANGE SIGNIFICANCE:** Section 150.0(m)13D has been added to incorporate appropriate alternate airflow and fan efficacy requirements for SDHV forced air systems. These values are achievable by all certified SDHV air conditioners and heat pump combinations. The change removes the burden of SDHV from having to comply with the airflow and fan watt values in the 2016 Energy Code via an exception, which was unachievable by this technology.

Exceptions 1 and 2 to Section 150.0(m)13B and D – These exceptions have been updated to include SDHV systems in their application. These changes ensure SDHV systems can be installed legally in California and held to efficiency standards that are appropriate for the unique features of the equipment. The changes recognize that the same situations and concerns about single zone central forced air systems can occur with SDHV systems.

# 150.0(n)
## Water Heating System

**CHANGE TYPE:** Modification and Addition

**CHANGE SUMMARY:** Updates were made to electrical specifications for gas or propane water heater systems serving individual dwelling units, ensuring homes are "heat pump water heater ready," allowing for a more streamlined transition to a greenhouse gas free appliance in the future.

**2019 CODE:**

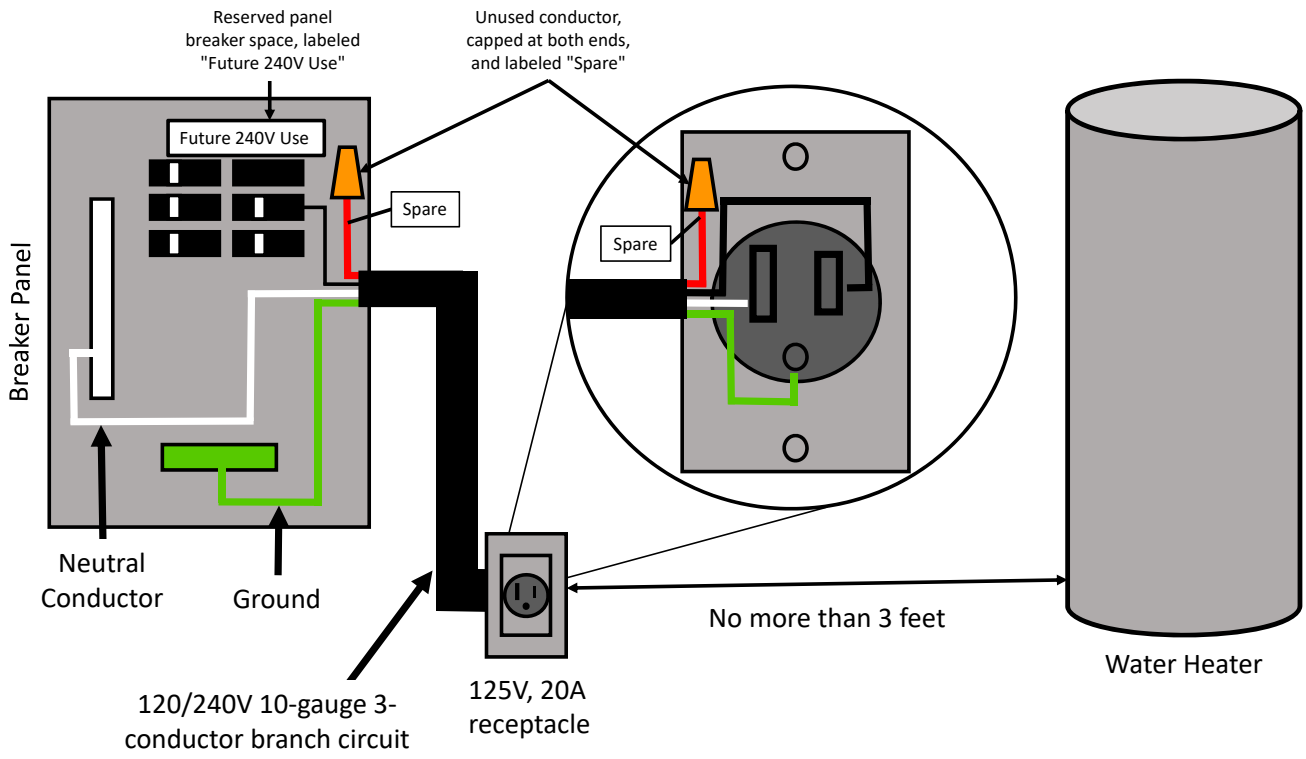
(n) **Water Heating System.**

1. Systems using gas or propane water heaters to serve individual dwelling units shall include the following components:
   A. A dedicated ~~120V~~ 125 volt, 20 amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor, 10 AWG copper branch circuit, within 3 feet from the water heater and accessible to the water heater with no obstructions. In addition, all of the following:
      i. Both ends of the unused conductor shall be labeled with the word "spare" and be electrically isolated; and
      ii. A reserved single pole circuit breaker space in the electrical panel adjacent to the circuit breaker for the branch circuit in A above and labeled with the words "Future 240V Use"; 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, and allows natural draining without pump assistance~~.~~; 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 shall meet the requirements of Section 110.3(c)5.
3. Solar water-heating systems and collectors shall be certified and rated by the Solar Rating and Certification Corporation (SRCC), the International Association of Plumbing and Mechanical Officials, Research and Testing (IAPMO R&T), or by a listing agency that is approved by the Executive Director.
4. Instantaneous water heaters with an input rating greater than 6.8 kBTU/hr (2kW) shall meet the requirements of Section 110.3(c)7.

**CHANGE SIGNIFICANCE:** Section 150.0(n) applies to gas or propane water heater systems that serve individual dwelling units. Virtually all high efficiency gas water heaters require an electrical connection. The requirements make it easier to switch to a heat pump water heater or high efficiency gas water heater in the future. The changes ensure that suitable circuitry is safely installed and appropriately labeled. Installing this infrastructure during the initial construction stage is significantly less costly than retrofitting at a later time.

Section 150.0(n)1A updates the specifications for the electric panel receptacle and its connection, the conductor, and the circuit breaker space. The change ensures the circuit will be compatible with future energy efficient heat pump water heater installations. It also clarifies the requirements for installing a spare, available electrical path that would minimize the cost of installing electric equipment in the future.

Section 150.0(n)3 states that solar water heating systems and collectors must be certified and rated by an entity approved by the Energy Commission's Executive Director. The International Association of Plumbing and Mechanical Officials, Research and Testing (IAPMO R&T) has been added to this section because they are now approved to perform rating and certification.




Heat Pump Water Heater Ready Requirements – This diagram illustrates how to satisfy the heat pump ready requirements of the 2019 Energy Code for newly constructed low-rise residential buildings. When designed with natural gas water heaters, these buildings must have the infrastructure to switch to an electric heat pump water heater in the future.
Source: Allen Wong, California Energy Commission, Blueprint Newsletter – Issue 130

# 150.0(o)1

## Requirements for Ventilation Systems and Indoor Air Quality, Amendments to ASHRAE 62.2

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** New design and performance specifications were added for ventilation systems in single family and multifamily residences in accordance with ASHRAE Standard 62.2-2016.

**2019 CODE:**

(o) **Requirements for Ventilation ~~for~~ and Indoor Air Quality.** All dwelling units shall meet the requirements of ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in ~~Low-Rise~~ Residential Buildings subject to the amendments specified in Section 150.0(o)1 below. All dwelling units shall comply with Section 150.0(o)2 below.

1. Amendments to ASHRAE 62.2 requirements.
   - A. Window operation is not a permissible method of providing the dwelling unit~~Whole-Building~~ v~~V~~entilation airflow ~~required in Section 4 of ASHRAE Standard 62.2~~specified in subsections C, E, or F below.
   - B. 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~~dwelling unit ventilation airflow required in Section 4 of ASHRAE Standard 62.2.
   - C. Single family detached dwelling units, and attached dwelling units not sharing ceilings or floors with other dwelling units, occupiable spaces, public garages, or commercial spaces shall have mechanical ventilation airflow provided at rates determined in accordance with ASHRAE 62.2 Sections 4.1.1 and 4.1.2 as specified in subsections i, ii, and iii below.
     - i. **Total Required Ventilation Rate [ASHRAE 62.2:4.1.1].** The total required ventilation rate shall be calculated using Equation 150.0-B

$$Q_{tot} = 0.03A_{floor} + 7.5(N_{br} + 1) \quad \textbf{(Equation 150.0-B)}$$

where

$Q_{tot}$ = total required ventilation rate, cfm

$A_{floor}$ = dwelling-unit floor area, $ft^2$

$N_{br}$ = number of bedrooms (not to be less than 1)

     - ii. **Effective Annual Average Infiltration Rate.** The effective annual average infiltration rate shall be determined in accordance with subsections a and b:
       - a. An enclosure leakage rate in cubic feet per minute at 50 Pa (0.2 inch water) ($Q_{50}$) shall be determined by either subsection 1, or subsection 2 below.
         1. $Q_{50}$ shall be calculated based on the conditioned volume of the dwelling unit and a default value for dwelling unit envelope leakage of 2 air changes per hour at 50 PA (0.2 inch water) (2 $ACH_{50}$) as specified by equation 150.0-C below.

$Q_{50}$ = $V_{du}$ × 2 $ACH_{50}$ / 60 min

**(Equation 150.0-C)**

where

$Q_{50}$ = leakage rate at 50 Pa.

$V_{du}$ = dwelling unit conditioned volume, $ft^3$.

$ACH_{50}$ = air changes per hour at 50 Pa (0.2 inch water)

2. If dwelling unit envelope leakage less than 2 $ACH_{50}$ is confirmed by field verification and diagnostic testing, $Q_{50}$ shall be calculated according to Equation 150.0-D below, using the value for dwelling unit envelope leakage less than 2 $ACH_{50}$ verified by the procedures specified in Reference Residential Appendix RA3.8.

$Q_{50}$ = $V_{du}$ × *Verified* $ACH_{50}$ / 60 min

**(Equation 150.0-D)**

where

$Q_{50}$ = leakage rate at 50 Pa.

$V_{du}$ = dwelling unit conditioned volume, $ft^3$.

$ACH_{50}$ = air changes per hour at 50 Pa (0.2 inch water).

b. The Effective Annual Average Infiltration Rate ($Q_{inf}$) shall be calculated using Equation 150.0-E [ASHRAE 62.2:4.1.2.1].

$Q_{inf}$ = 0.052 × $Q_{50}$ × *wsf* × $[H/H_r]^z$.

**(Equation 150.0-E)**

where

$Q_{inf}$ = effective annual infiltration rate, cfm (L/s).

$Q_{50}$ = leakage rate at 50 Pa from equation 150.0-C, or equation 150.0-D.

*wsf* = weather and shielding factor from Table 150.0-D.

$H$ = vertical distance between the lowest and highest above-grade points within the pressure boundary, ft (m).

$H_r$ = reference height, 8.2 ft (2.5 m).

$z$ = 0.4 for the purpose of calculating the Effective Annual Average Infiltration Rate.

iii. **Required Mechanical Ventilation Rate [ASHRAE 62.2:4.1.2]**

The Required Mechanical Ventilation Rate ($Q_{fan}$) shall be calculated using Equation 150.0-F.

$$Q_{fan} = Q_{tot} - \Phi\,(Q_{inf} \times A_{ext}) \qquad \textbf{(Equation 150.0-F)}$$

where

$Q_{fan}$ = required mechanical ventilation rate, cfm (L/s)

$Q_{tot}$ = total required ventilation rate, cfm (L/s) from Equation 150.0-B

$Q_{inf}$ = effective annual average infiltration rate, cfm (L/s) from Equation 150.0-E

$A_{ext}$ = 1 for single-family detached homes, or the ratio of exterior envelope surface area that is not attached to garages or other dwelling units to total envelope surface area for attached dwelling units not sharing ceilings or floors with other dwelling units, occupiable spaces, public garages, or commercial spaces.

$\Phi$ = 1 for balanced ventilation systems and $Q_{inf}/Q_{tot}$ otherwise

D. Air filtration shall conform to the specifications in Section 150.0(m)12. Compliance with ASHRAE 62.2 Sections 6.7 (Minimum Filtration) and 6.7.1 (Filter Pressure Drop) shall not be required.

E. Multifamily attached dwelling units shall have mechanical ventilation airflow provided at rates in accordance with Equation 150.0-B [ASHRAE 62.2:4.1.1], and comply with one of the following subsections i or ii below. When subsection ii below is utilized for compliance, all dwelling units in the multifamily building shall use the same ventilation system type.

i. A balanced ventilation system shall provide the required dwelling-unit ventilation airflow, or

ii. Continuously operating supply ventilation systems, or continuously operating exhaust ventilation systems shall be allowed to be used to provide the required dwelling unit ventilation airflow if the dwelling-unit envelope leakage is less than or equal to 0.3 cubic feet per minute at 50 Pa (0.2 inch water) per $ft^2$ of dwelling unit envelope surface area as confirmed by field verification and diagnostic testing in accordance with the procedures specified in Reference Residential Appendix RA3.8.

F. Multifamily building central ventilation systems that serve multiple dwelling units shall be balanced to provide ventilation airflow for each dwelling unit served at a rate equal to or greater than the rate specified by Equation 150.0-B [ASHRAE 62.2:4.1.1], but no more than twenty percent greater than the specified rate. These systems shall utilize balancing means to ensure the dwelling-unit airflows can be adjusted to meet this balancing requirement. These system balancing means may

include but not be limited to constant air regulation devices, orifice plates, and variable speed central fans. ~~Additionally, all dwelling units shall meet the following requirements:~~

G. Kitchen range hoods shall be rated for sound in accordance with Section 7.2 of ASHRAE 62.2.

**EXCEPTION to Section 150.0(o)1G–**Kitchen range hoods may be rated for sound at a static pressure determined at working speed as specified in HVI 916 section 7.2.

H. Compliance with ASHRAE 62.2 Section 6.5.2 (Space Conditioning System Ducts) shall not be required.

I. Compliance with ASHRAE 62.2 Section 4.4 (Control and Operation) shall require manual switches associated with dwelling unit ventilation systems to have a label clearly displaying the following text, or equivalent text: "This switch controls the indoor air quality ventilation for the home. Leave it on unless the outdoor air quality is very poor."

**CHANGE SIGNIFICANCE:** The new requirements in Section 150.0(o) focus on health and safety for occupants of dwelling units. The changes are consistent with statutes and policies that protect and enhance the indoor air quality in California's buildings.

Section 150.0(o) – This section now incorporates ASHRAE 62.2-2016 "Ventilation and Indoor Air Quality in Residential Buildings" by reference. It also adds "amendments" that augment and/or replace ASHRAE specifications in A, B, C, D, E, F, G, H, and I. A new numbering scheme improves clarity, and the ASHRAE term "whole building" has been replaced with "dwelling unit" in this subsection. Although the 2016 version of ASHRAE 62.2 uses the term 'whole-building,' the 2019 Energy Code uses the term "dwelling unit" throughout for consistency.

Section 150.0(o)1C – This section introduces a simplified method for calculating the mechanical ventilation airflow rate for single-family and various types of attached dwelling units. The simplified calculation relieves the responsibility of measuring a dwelling's enclosure leakage in the field. The test is required when verifying enclosure leakage values less than 2 $ACH_{50}$. Subsections i, ii, iii include the ASHRAE 62.2 calculations for clarity. Section 150.0(o)1D references the air filtration specifications in Section 150.0(m)12 instead of those in ASHRAE 62.2. It applies to supply ventilation systems and the supply side of balanced ventilation systems. In addition, the filtration particle size efficiency has increased from MERV 6 to MERV 13. The change also clarifies that compliance with Sections 6.7 (Minimum Filtration) and 6.7.1 (Filter Pressure Drop) of ASHRAE 62.2 is not required.

Section 150.0(o)1E specifies two "compartmentalization" options to reduce pollutant transfer between attached multifamily dwelling units. Only one of the two options can be used for compliance. Building designs that use different types of ventilation systems can be less effective and less energy efficient. Balancing the ventilation system throughout the building provides the intended benefits to a multifamily dwelling that shares walls with other units and indoor spaces. The reason for this requirement is that pressurizing a space pushes depleted or polluted air into the adjacent spaces, and depressurizing a space pulls depleted or polluted air in from adjacent spaces.

Option 1 requires a balanced ventilation system that supplies the same amount of outside air as the exhaust air, minimizing pressure differences between multifamily dwellings that could transfer contaminated air between units. Using a balanced strategy ensures that air is exchanged with the outside and not with adjacent indoor spaces.

Option 2 requires the dwelling to be sealed to minimize leakage between adjacent units. A HERS Rater must verify the enclosure leakage is less than 0.3 cubic feet per minute at 50 Pa per square feet of enclosed area.

Getty Images

Kitchen Range Hood – Under the 2019 Energy Code, kitchen range hoods must continue to meet maximum sone ratings, and a minimum CFM rating. In addition to these requirements, the Energy Code now requires that these values be verified by a third-party HERS Rater.

Section 150.0(o)1F applies to multifamily buildings where central ventilation systems serve multiple dwelling units. The airflow rate for every dwelling unit must be greater than or equal to the specified rate in Table 150.0-B (but cannot exceed 20% of the specified rate). The ventilation system designer may choose equipment such as constant air regulation devices, orifice plates, and variable speed central fans. This change limits the impact of high differential pressures throughout the building and prevents inadvertent indoor air quality impacts.

Section 150.0(o)1G requires that kitchen range hoods comply with the sound rating specification in ASHRAE 62.2 Section 7.2. These rating specifications were first adopted by reference to ASHRAE 62.2 in the 2008 Energy Code. It also includes an exception that allows an alternate test method and rate specification. About 50% of the kitchen range hood models listed in the HVI directory complied when the 2019 Energy Code was adopted in May of 2018, and will not need additional testing.

Section 150.0(o)1H clarifies that compliance with ASHRAE 62.2 Section 6.5.2 (Space Conditioning System Ducts) is not required. The change eliminates a conflict between the ASHRAE 62.2 duct leakage requirements and the duct leakage requirements in Sections 150.0(m)11 and 150.2(b)1D and E.

Section 150.0(o)1I requires a label with specified wording for the mandatory mechanical ventilation fan control. The label addresses concern that IAQ ventilation fans are often turned off by occupants who do not understand that the fans must be operated to protect their indoor air quality.

# 150.0(o)2

## Requirements for Ventilation Systems and Indoor Air Quality, Field Verification and Diagnostic Testing

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** HERS raters must verify compliance with airflow and sound ratings for kitchen range hoods.

**2019 CODE:**

(o) **Requirements for Ventilation for and Indoor Air Quality.** All dwelling units shall meet the requirements of ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in ~~Low-Rise~~ Residential Buildings subject to the amendments specified in Section 150.0(o)1 below. All dwelling units shall comply with Section 150.0(o)2 below.

[…]

~~1~~2. **Field Verification and Diagnostic Testing.**

A. **Airflow Performance.** The ~~Whole-Building Ventilation~~ dwelling unit ventilation airflow required by Sections 150.0(o)1C, 150.0(o)1E, and 150.0(o)1F ~~Section 4 of ASHRAE Standard 62.2~~ shall be confirmed through field verification and diagnostic testing in accordance with the applicable procedures specified in Reference Residential Appendix RA3.7.

B **Kitchen Range Hoods.** The installed kitchen range hood shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.7.4.3 to confirm the model is rated by HVI to comply with the following requirements:

i. The minimum ventilation airflow rate as specified in Section 5 of ASHRAE 62.2.

ii The maximum sound rating as specified in Section 150.0(o)1G.

**CHANGE SIGNIFICANCE:** Ventilation systems waste energy when indoor air quality is not improved by their operation. These measures recognize the value of checking for proper installation and certification verification before the occupants move in. To assist with code enforcement, the measures in Section 150.0(o)2 require field verification and diagnostic testing by requiring third-party HERS inspection. A HERS rater must verify the airflow of dwelling unit ventilation systems, and the certification of kitchen range hoods.

Section 150.0(o)2A – This section now specifies the equations in Sections 150.0(o)1C, 150.0(o)1E, and 150.0(o)1F for airflow performance verification. A third-party HERS rater must confirm compliance with the ventilation system airflow requirements for each dwelling unit.

Section 150.0(o)2B introduces a new HERS verification requirement. It requires HERS verification that the hood's airflow and sound ratings meet the requirements of Section 5 of ASHRAE 62.2. Currently, the Home Ventilation Institute (HVI) and the Association of Home Appliance Manufacturers (AHAM) are the two approved programs for certifying and maintaining directories for these products.

For AHAM's certified range hood directory, visit https://www.aham.org/AHAM/What_We_Do/Kitchen_Range_Hood_Certification.

For HVI's certified rated product directory, visit https://www.hvi.org/hvi-certified-products-directory/.

PART 8

# Low-Rise Residential Buildings—Performance and Prescriptive Compliance Approaches

## Subchapter 8

Subchapter 8 defines the prescriptive and performance compliance approaches and establishes prescriptive requirements that are applicable low-rise residential buildings. This subchapter consists solely of Section 150.1.

Section 150.1(a) reiterates that all mandatory sections applicable to these buildings must be met, in addition to the performance and prescriptive measures of Section 150.1 where applicable. Section 150.1(b) defines the performance standards for these buildings, identifying how compliance and energy budgets are measured differently depending on the scope of work for the building. Section 150.1(c) defines all prescriptive requirements for single-family and multifamily low-rise residential buildings. These requirements are summarized in Tables 150.1-A for single-family buildings, and Table 150.1-B for multifamily buildings. ■

**150.1**

**Performance and Prescriptive Compliance Approaches for Low-Rise Residential Buildings**

**150.1(b)**

**Performance Standards**

**150.1(b)1 and 2**

**Newly Constructed Buildings, and Additions and Alterations to Existing Buildings**

**150.1(b)3B**

**Compliance Demonstration Requirements for Performance Standard; Field Verification**

**150.1(c)**

**Prescriptive Standards/Component Packages**

**150.1(c)1A**

**Insulation**

**150.1(c)1B**

**Walls**

**150.1(c)1E**

Quality Insulation Installation

**150.1(c)3**

Fenestration

**150.1(c)5**

Doors

**150.1(c)7A**

Space Heating and Space Cooling; Refrigerant Charge

**150.1(c)8**

Domestic Water Heating

**150.1(c)10**

Central Fan Integrated Ventilation Systems

**150.1(c)12**

Ventilation Cooling

**150.1(c)14**

Photovoltaic Requirements

**TABLE 150.1-A**

Component Package – Single Family Standard Building Design

**TABLE 150.1-B**

Component Package – Multifamily Standard Building Design

# 150.1(b)1 and 2

## Performance Standards; Newly Constructed Buildings; and Additions and Alterations to Existing Buildings

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** The performance approach has been modified for newly constructed buildings to include a new metric for demonstrating compliance called the Energy Design Rating.

**2019 CODE:**

(b) **Performance Standards.** A building complies with the performance standards if the energy consumption ~~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~~ using Commission-certified compliance software as specified by the Alternative Calculation Methods Approval Manual.

1. **Newly Constructed Buildings.** The Energy Budget for newly constructed buildings is expressed in terms of the Energy Design Rating, which is based on time-dependent valuation (TDV) energy. The Energy Design Rating (EDR) has two components, the Energy Efficiency Design Rating, and the Solar Electric Generation and Demand Flexibility Design Rating. The Solar Electric Generation and Demand Flexibility Design Rating shall be subtracted from the Energy Efficiency Design Rating to determine the Total Energy Design Rating. The Proposed Building shall separately comply with the Energy Efficiency Design Rating and the Total Energy Design Rating.

   **EXCEPTION to Section 150.1(b)1.** A community shared solar electric generation system, or other renewable electric generation system, and/or community shared battery storage system, which provides dedicated power, utility energy reduction credits, or payments for energy bill reductions, to the permitted building and is approved by the Energy Commission as specified in Title 24, Part 1, Section 10-115, may offset part or all of the solar electric generation system Energy Design Rating required to comply with the Standards, as calculated according to methods established by the Commission in the Residential ACM Reference Manual.

2. **Additions and Alterations to Existing Buildings.** The Energy Budget for additions and alterations is expressed in terms of TDV energy.

   ~~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, 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, mechanical ventilation and water heating. The energy budget for the Proposed Design Building is~~

~~reduced if on-site renewable energy generation is installed, according to methods established by the Commission in the Residential ACM Reference~~

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.~~

**CHANGE SIGNIFICANCE:** The purpose of the changes to this section is to incorporate the use of the Energy Design Rating (EDR) concept, including component EDRs for energy efficiency, solar electric generation and design flexibility, and their combination into a total EDR for each newly constructed building.

The previous three subsections were replaced by two new subsections, one for newly constructed buildings, and one for additions and alterations to existing buildings to improve clarity and accuracy. The EDR expands the previous scope of the Energy Code to not only address building energy efficiency measures, but also to incorporate other means to reduce building energy consumption, including the major amount of energy used by plug loads (resulting from equipment and devices brought into homes by occupants that are plugged into electrical outlets), through onsite renewable energy generation and demand response/flexibility measures.

The EDR score enables a comprehensive focus that maximizes the ability for newly constructed buildings to be designed and built to be harmonized with California's electricity grid, consistent with the policies of the Commission's sister agencies, the California Independent System Operator, The California Public Utilities Commission, and the Air Resources Board, to contribute to achievement of California's climate change goals at lowest cost. For the first time this EDR metric is incorporated into the Energy Code for newly constructed, low-rise buildings.

An EDR score of 100 represents a building that consumes the amount of energy that a building built to the 2006 *International Energy Conservation Code*® (IECC®) would have consumed. A score of 0 represents a building that produces at least the same amount of energy it consumes over one year, making it a zero net energy building.

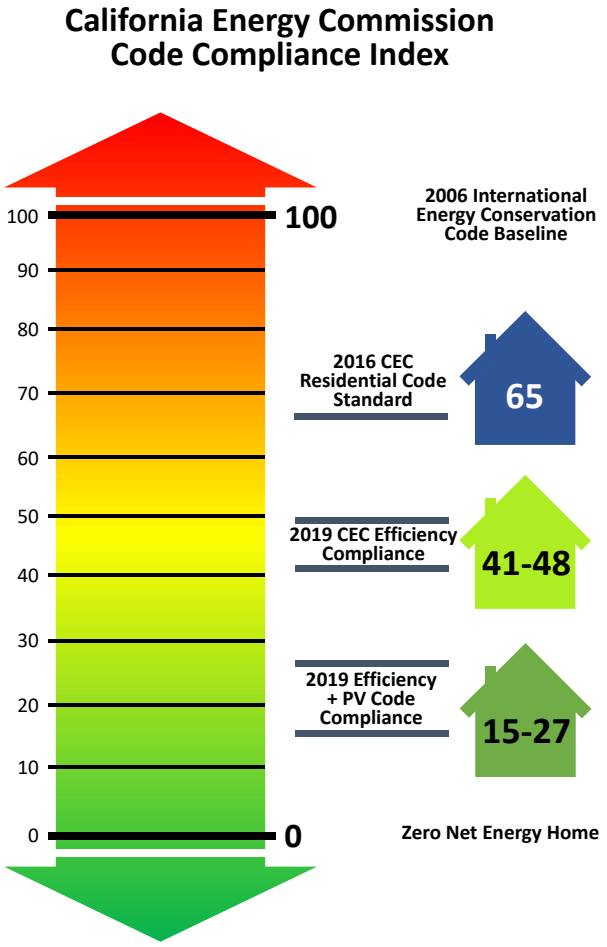
For compliance with the 2019 Energy Code, two EDR scores must be met independently:

1. **Efficiency EDR**, which represents that EDR score of 100, minus energy savings for space heating, cooling, ventilation, water heating, plus a limited credit for battery.
2. **Total EDR**, which represents the Efficiency EDR minus a compliance credit for a photovoltaic system (PV), battery, and other demand flexibility measures if modeled.

The Efficiency EDR score will generally be in the range of 41–48 and will vary by climate zone and building size. Once PV is added into the equation, the Total EDR score will generally be in the range of 15–27.

For the first time, the Energy Code is also recognizing the installation of a battery system and demand flexibility measures. These options can assist with achieving the maximum EDR scores for the buildings they're designed in.

An exception from the PV requirements was also added for newly constructed buildings which are served by a community shared solar electric system, or other community renewable electric generation system. These systems must be approved by the Energy Commission, as explained in Section 10-115 of the Administrative Code (Title 24, Part 1). A similar variance is also provided in this exception for homes served by a community shared battery system.




Energy Design Rating (EDR), as defined by the California Energy Commission, is an alternate way to express the energy performance of a building using a scoring system where 100 represents the energy performance of a Residential Energy Services (RESNET) reference home characterization of the 2006 IECC with California modeling assumptions. A score of 0 represents the energy performance of a building that combines high levels of energy efficiency with renewable generation to "zero out" its TDV energy.

California's Energy Design Rating Sample Scale – An EDR score of 100 represents a low-rise residential building built to the 2006 *International Energy Conservation Code.* A low-rise residential building built to the 2019 Energy Code, including the addition of photovoltaic system requirements, will generally have an EDR score between 15 and 27.
Source: California Energy Commission

# 150.1(b)3B

## Performance Standards; Compliance Demonstration Requirements for Performance Standard; Field Verification

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** Section references were added to the verification procedures for HERS verification measures when credit is taken for them via the performance approach.

**2019 CODE:**

(b) **Performance Standards.** A building complies with the performance standards if the energy consumption ~~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~~ using Commission-certified compliance software as specified by the Alternative Calculation Methods Approval Manual.

[…]

43. **Compliance Demonstration Requirements for Performance Standards.**

[…]

B. **Field Verification.** When performance of installed features, materials, components, manufactured devices ~~and~~ or systems ~~performance~~ above the minimum specified in Section 150.1(c) is necessary for the building to comply with Section 150.1(b), or is necessary to achieve a more stringent local ordinance, field verification shall be performed in accordance with the applicable requirements in the following subsections, and the results of the verification(s) shall be documented on applicable Certificates of Installation pursuant to Section 10-103(a)3~~,~~ and applicable Certificates of Verification pursuant to Section 10-103(a)5. ~~, in accordance with the following requirements when applicable:~~

i. **SEER Rating.** When performance compliance requires installation of a space ~~a~~ conditioning system with a SEER rating that is greater than the minimum SEER rating required by TABLE 150.1-A or B, the installed system shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.4.4.1.

ii. **EER Rating.** When performance compliance requires installation of a space conditioning system ~~that meets or exceeds a specified~~ with an EER rating greater than the standard design value for EER, the installed system shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.4.4.1.

iii. **Low Leakage Air Handler.** When performance compliance requires installation of a low leakage air-handling unit ~~that meets the qualifications in Reference Joint Appendix JA9~~, the installed air-handling unit shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.1.4.3.9.

iv. **HSPF Rating.** When performance compliance requires installation of a heat pump system with an HSPF rating that is greater than the minimum Heating Seasonal Performance Factor (HSPF) rating required by TABLE 150.1-A or B, the installed system shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.4.4.1.

v. **Heat Pump - Rated Heating Capacity.** When performance compliance requires installation of a heat pump system, the heating capacity values at 47°F and 17°F shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.4.4.2.

vi. **Whole-house fan.** When performance compliance requires installation of a whole-house fan, the whole-house fan ventilation airflow rate and fan efficacy shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.9.

vii. **Central Fan Ventilation Cooling System.** When performance compliance requires installation of a central fan ventilation cooling system, the installed system shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.3.4.

viii. **Building Enclosure Air Leakage.** When performance compliance requires a building enclosure leakage rate that is lower than the standard design, the building enclosure shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.8.

ix. **Quality Insulation Installation (QII).** When performance compliance requires field verification of QII, the building insulation system shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.5.

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to identify appropriate field verification methods for several third-party HERS verification measures. The requirements for each field verification procedure are described in the referenced sections of Reference Residential Appendix RA3 (RA3). Third-party field verification requirements are necessary to ensure that the potential energy efficiency benefits of installed equipment are realized. These measures are not required but can be selected as part of a building's overall compliance, and when selected, must be verified by a HERS rater.

HERS Verified Blower Door Test – Envelope leakage, when modeled, must be verified by a third party HERS rater.
Source: California Energy Commission

Project Status Report — CalCERTS, Inc — 1 of 2

| | |
|---|---|
| Code Year Standards: | 2013 |
| Project Name: | Stewmaker Performance Demo |
| Project Type: | New Construction SFR |
| Address: | 1516 9th Street |
| City / State / Zip: | Sacramento / CA / 95814 |
| Enforcement Agency: | City of Sacramento |
| Permit Number: | 123456789 |

Easy to verify @ calcerts.com

| | |
|---|---|
| HERS VERIFICATION MEASURES: | NOT COMPLETE |
| OVERALL STATUS: | NOT COMPLETE |

CF1R INFORMATION - Certificate of Compliance

| | |
|---|---|
| Certificate Type: | Compliance |
| Registered Form: | CF1R-PRF-03-E |
| Registered Date: | 04/05/2016 08:30 |
| Registration Number: | 216-N01254JA-000000000-0000 |

ADDITIONAL CF1Rs:

| System | Form | Registered Date | Registration Number | |
|---|---|---|---|---|
| | CF1R-SAA-01 | | 216-N01254JA-000000000-0000 | |

CF2R INFORMATION - Certificate of Installation

| System | Form | Registered Date | Registration Number | |
|---|---|---|---|---|
| | CF2R-ENV-01 (Penetrations, Installation) | | 216-N01254JA-[illegible] | |
| | CF2R-ENV-02 (Envelope Air Sealing) | | 216-N01254JA-E020001A-0000 | |
| | CF2R-ENV-03 (Insulation Installation) | | 216-N01254JA-E030001A-0000 | |
| | CF2R-ENV-04 (Roofing-Radiant Barrier) | | 216-N01254JA-E040001A-0000 | |
| | CF2R-MCH-01 (Space Conditioning Systems, Ducts and Fans) | 04/05/2016 09:40 | 216-N01254JA-M010001A-0000 | |
| System 1 | CF2R-MCH-20 (Duct Leakage) | 04/05/2016 09:40 | 216-N01254JA-M200002A-0000 | |
| System 1 | CF2R-MCH-23 (Airflow) | 04/05/2016 09:40 | 216-N01254JA-M230001A-0000 | |
| System 1 | CF2R-MCH-22 (Fan Efficacy) | 04/05/2016 09:40 | 216-N01254JA-M220001A-0000 | |
| System 1 | CF2R-MCH-25 (Refrigerant Charge) | 04/05/2016 09:40 | 216-N01254JA-M250001A-0000 | |
| | CF2R-MCH-27 (IAQ and MV) | 04/05/2016 09:40 | 216-N01254JA-M270001A-0000 | |
| | CF2R-PLB-02 (SD HWS Distribution) | 04/05/2016 09:40 | 216-N01254JA-P020001A-0000 | |

CF3R INFORMATION - Certificate of Verification

| System | Form | Registered Date | Registration Number | |
|---|---|---|---|---|
| | CF3R-MCH-27 (IAQ and MV) | | 216-N01254JA-M270001A-M27A | |
| System 1 | CF3R-MCH-20 (Duct Leakage) | 04/11/2016 12:52 | 216-N01254JA-M200002A-M20A | |

CA Building Energy Efficiency Standards — 2013 Residential Compliance — HERS Provider: CalCERTS, Inc. — Dec 2015

HERS Project Status Report (PSR) – This report is generated within the HERS registries for every low-rise residential project that has HERS verification measures. It lists all applicable forms for the project and indicates whether they are complete or incomplete. It is an excellent resource and can be used by the enforcement agency at the final stage of a project to ensure that all applicable forms have been completed and registered. Both CalCERTS and CHEERS generate a PSR.
Source: CalCERTS Data Registry

# 150.1(c)1A

## Prescriptive Standards – Insulation

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** The above-roof-deck insulation option used for prescriptive compliance with the high-performance attic option was removed.

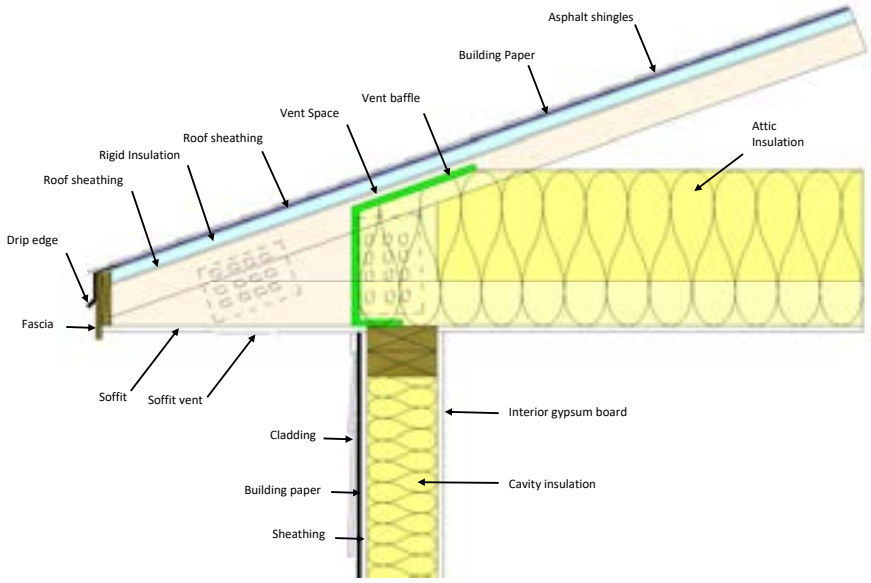
**2019 CODE:**

(c) **Prescriptive Standards/Component Packages.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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. Roof and Ceiling insulation shall be installed in a ventilated attic with an *R*-value equal to or greater than that shown in ~~Table~~ TABLE 150.1-A or B meeting options ii through or iii below.
      i. Option ~~A~~A: RESERVED.
      ii. Option B: A minimum *R*-value of ~~continuous~~ insulation installed ~~above~~ between the roof rafters in contact with the roof deck and an additional layer of ceiling insulation located between the attic and the conditioned space when meeting Section 150.1(c)9A; or
      iii. Option ~~B~~C: A minimum *R*-value of ceiling insulation located between the attic and the conditioned space when meeting Section 150.1(c)9B. ~~A minimum R-value of insulation installed between the roof rafters in contact with the roof deck and an additional layer of ceiling insulation located between the attic and the conditioned space when meeting Section 150.1(c)9A; or~~
      ~~iii. Option C: A minimum R-value of ceiling insulation located between the attic and the conditioned space when meeting Section 150.1(c)9B.~~

**NOTE:** Low rise residential single family and ~~multi-family~~multi-family buildings with the ducts and air handler located in the conditioned space, as specified by Section 150.1(c)9B, need only comply with insulation requirements of Option C.

**CHANGE SIGNIFICANCE:** The purpose of the modification to Section 150.1(c)1A is to remove high performance attic option A from the prescriptive package. Above roof deck insulation may still be installed to comply with roof and ceiling insulation requirements under the performance compliance approach. This change is necessary to prevent discrepancies between prescriptive alternatives, where equivalency is not guaranteed without building modeling.




High-Performance Attic with Insulation Above Rafters – This prescriptive option for compliance with the high-performance attic requirements has been removed from the 2019 Energy Code. When complying via the performance approach, installing insulation above the roof rafters is still acceptable, and can be modeled for compliance.
Source: California Energy Commission, 2019 Residential Compliance Manual

# 150.1(c)1B

## Prescriptive Standards – Walls

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** The purpose of the clarification to this section is to provide consistency in phrasing and add a reference to the multifamily Table 150.1-B.

**2019 CODE:**

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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.**

[…]

B. **Walls.**

~~i. Walls (including heated basements and crawl spaces) shall be insulated such that the opaque wall has an assembly U-factor equal to or less than shown in Table 150.1-A, or walls shall be insulated between wood framing with an R-value equal to or greater than shown in TABLE 150.1-A. The U-factors shown are maximum U-factors for the opaque wall assembly. Alternatively, for mass walls above grade and for below grade walls with insulation installed on the interior, the R-values shown are the minimum R-values for insulation installed between wood-framing members; and for below grade walls with exterior insulation, the R-values shown are the minimum R-values for continuous insulation.~~ Framed exterior walls shall be insulated such that the exterior wall has an assembly *U*-factor equal to or less than that shown in TABLE 150.1-A or B. The *U*-factors shown are maximum *U*-factors for the exterior wall assembly.

ii. Mass walls above grade and below grade shall be insulated such that the wall has an assembly *U*-factor equal to or less than that shown in TABLE 150.1-A or B, or walls shall be insulated with continuous insulation that has an R-value equal to or greater than that shown in TABLE 150.1-A or B. "Interior" denotes continuous insulation installed on the inside surface of the wall, and "exterior" denotes continuous insulation installed on the outside surface of the wall.

iii. Other unframed exterior walls, excluding mass walls, shall meet the requirements for framed walls shown in TABLE 150.1-A or B.

**CHANGE SIGNIFICANCE:** The purpose of the change to Section 150.1(c)1B is to simplify language relating to insulation requirements and use consistent terminology. Language was also added to the mass wall insulation requirements. This language was added to clarify that insulation *R*-values found in the prescriptive tables for mass walls are for continuous insulation.

**TABLE 150.1-A Component Package—Single-Family Standard Building Design**

| | Single Family | Climate Zone 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Building Envelope Insulation | | | | | | | | | | | | | | | | | |
| Walls, Above Grade | Framed[3] | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.065 | U 0.065 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 |
| | Mass Wall Interior[4,5] | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 17 |
| | Mass Wall Exterior[4,5] | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.125 R 8.0 | U 0.077 R 13 |
| Walls, Below Grade | Below Grade Interior[6] | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.077 R 13 | U 0.067 R 15 |
| | Below Grade Exterior[6] | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.200 R 5.0 | U 0.100 R 10 | U 0.100 R 10 | U 0.053 R 19 |

Table 150.1-A Excerpt – Prescriptive wall insulation requirements vary by climate zone, assembly type, and for mass walls, location of insulation. Climate Zone 16, California's coldest climate, has higher prescriptive wall insulation requirements when compared with the rest of California.
Source: California Energy Commission

# 150.1(c)1E

## Prescriptive Standards – Quality Insulation Installation

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** HERS Quality Insulation Installation (QII) verification was added to the prescriptive compliance requirements.

**2019 CODE:**

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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.**

   […]

   E. All buildings shall comply with the Quality Insulation Installation (QII) requirements shown in TABLE 150.1-A or B. When QII is required, insulation installation shall meet the criteria specified in Reference Appendix RA3.5.

**CHANGE SIGNIFICANCE:** The purpose of the addition of Section 150.1(c)1E is to require HERS Quality Insulation Installation (QII) verification measures as a part of prescriptive compliance. QII was found to provide a substantial benefit in low-residential buildings in excess of its cost over the economic life of the building, except for multifamily buildings in Climate Zone 7.

QII requires HERS third-party inspection to verify that an air barrier and insulation are installed correctly. This eliminates or reduces common problems associated with poor installation. These QII HERS verification requirements include inspections at the framing stage before insulation is installed, and at the insulation stage before the walls are enclosed. The HERS verification requirements and procedures for QII verification can be found in Section RA3.5 of the 2019 Reference Residential Appendices.

Wall Insulation – Third-party HERS verification of Quality Insulation Installation (QII) is now a prescriptive requirement for low-rise residential buildings.
Source: California Energy Commission

# 150.1(c)3

## Prescriptive Standards – Fenestration

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Grammar was corrected, phrasing was improved, and a reference to glazed doors was added.

**2019 CODE:**

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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:

[…]

3. **Fenestration.**

A. Installed fenestration products, including glazed doors, shall have an area-weighted average *U*-factor and Solar Heat Gain Coefficient (SHGC) ~~no greater than the~~meeting the applicable fenestration value~~s~~ in TABLE 150.1-A or B and shall be determined in accordance with Sections 110.6(a)2 and 110.6(a)3.

**EXCEPTION 1 to Section 150.1(c)3A:** For each dwelling unit up to 3 square feet of new glazing area installed in doors and up to 3 square feet of new tubular skylights area with dual-pane diffusers shall not be required to meet the *U*-factor and SHGC requirements of TABLE 150.1-A or B.

**EXCEPTION 2 to Section 150.1(c)3A:** For each dwelling unit up to 16 square feet of new skylight area with a maximum *U*-factor of 0.55 and a maximum SHGC of 0.30.

**EXCEPTION 3 to Section 150.1(c)3A** For fenestration containing chromogenic type glazing:

i. ~~t~~The lower-rated labeled *U*-factor and SHGC shall be used with automatic controls to modulate the amount of solar gain and light transmitted into the space in multiple steps in response to daylight levels or solar intensity;

ii. ~~c~~Chromogenic glazing shall be considered separately from other fenestration; and

iii. ~~a~~Area-weighted averaging with other fenestration that is not chromatic 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 that meets the maximum area restriction, the *U*-factor and SHGC can be determined in accordance with the Nonresidential Reference Appendix NA6 or use default values in TABLE 110.6-A and TABLE 110.6-B.

[…]

**CHANGE SIGNIFICANCE:** The purpose of the changes to Section 150.1(c)3A are to correct capitalization, provide consistency in phrasing, add a reference to glazed doors, and update references to Table 150.1-A and Table 150.1-B, consistent with changes to those tables and changes to Section 150.1(c)5.

# 150.1(c)5

## Prescriptive Standards – Doors

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** New prescriptive efficiency requirements were added for doors that separate conditioned space from unconditioned spaces, or the outdoors.

**2019 CODE:**

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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:

[…]

5. ~~**RESERVED**~~**Doors.** Installed swinging door products separating conditioned space from outside or adjacent unconditioned space, but not including glazed door products, shall have an area-weighted average *U*-factor no greater than the applicable door value in TABLE 150.1-A or B and shall be determined in accordance with Section 110.6(a)2. Glazed door products are treated as fenestration products in Sections 150.1(c)3 and 150.1(c)4.

   **EXCEPTION to Section 150.1(c)5:** Swinging doors between the garage and conditioned space that are required to have fire protection are not required to meet the applicable door value in TABLE 150.1-A or B.

**CHANGE SIGNIFICANCE:** The purpose of the change to Section 150.1(c)5 is to introduce prescriptive requirements for doors that separate conditioned spaces from and unconditioned spaces or the outdoors. These doors now must meet a prescriptive maximum *U*-factor of 0.20 and must be rated by the National Fenestration Rating Council (NFRC) for their efficiencies to be recognized by the Energy Code. If a door is not NFRC rated, it must use default ratings, as described in Table 4.5.1 of Section JA4.5 of the 2019 Reference Joint Appendices. As with all prescriptive requirements, this measure can be traded away via the performance approach.

An exception was also added to this new requirement for doors that are required to have fire protection. This was added to prevent conflict with fire safety requirements.

Getty Images

Doors – Doors separating conditioned spaces from unconditioned spaces or the outdoors are subject to a prescriptive maximum *U*-factor of 0.20. Doors that are required to have fire protection are exempt from this requirement.

Table 4.5.1 of the 2019 Reference Appendices – This table assigns default values for doors that are not rated by the NFRC.

**TABLE 4.5.1 Doors**

~~**Table 4.5.1 of the 2019 Reference Appendices – This table assigns default values for doors that are not rated by the NFRC.**~~

| Description | | U-factor (Btu/°F ft²) A |
|---|---|---|
| Uninsulated single-layer metal swinging doors or non-swinging doors, including single-layer uninsulated access hatches and uninsulated smoke vents. | 1 | 1.45 |
| Uninsulated double-layer metal swinging doors or non-swinging doors, including double-layer uninsulated access hatches and uninsulated smoke vents. | 2 | 0.70 |
| Insulated metal swinging doors including fire rated doors, insulated access hatches and insulated smoke vents. | 3 | 0.50 |
| Wood doors, minimum nominal thickness of 1 $^{3}/_{4}$ in. (44 mm), including panel doors with minimum panel thickness of 1 $^{1}/_{8}$ in. (28mm), and solid core flush doors, and hollow core flush doors | 4 | 0.50 |
| Any other wood door | 5 | 0.60 |
| Uninsulated single layer metal roll up doors including fire rated door | 6 | 1.45 |
| Insulated single layer metal sectional doors, minimum insulation nominal thickness of $^{3}/_{8}$ inch; expanded polystyrene (R-4 per inch) | 7 | 0.179 |

Source: ASHRAE 90.1-2007, Section A7

# 150.1(c)7A

## Prescriptive Standards – Space Heating and Space Cooling – Refrigerant Charge

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Airflow requirements for small duct high velocity (SDHV) air conditioners and heat pumps were added to the refrigerant charge verification requirements and a reference to Reference Joint Appendix JA5 was changed to Section 110.12.

**2019 CODE:**

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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:

[…]

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 all applicable requirements of Sections 150.0 and 150.1(c)7A.

   A. **Refrigerant Charge.** When refrigerant charge verification or fault indicator display is shown as required by TABLE 150.1-A or B, the system shall comply with either Table 150.1(c)7Ai or 150.1(c)7Aii:

      i. Air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted packaged systems, small duct high velocity systems, and mini-split systems, shall comply with Subsections a, b and c, unless the system is of a type that cannot be verified using the specified procedures:

         a. Have measurement access holes (MAH) installed according to the specifications in the Reference Residential Appendix Section RA3.2.2.3; and

            **EXCEPTION to Section 150.1(c)7Aia:** Systems that cannot conform to the specifications for hole location in Reference Residential Appendix Figure RA3.2-1, shall not be required to provide holes as described in Figure RA3.2-1.

         b. System airflow rate ~~greater than or equal to 350 cfm per ton~~ in accordance with Subsection I or II, shall be confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in ~~shall be demonstrated by the installer and be verified by the HERS rater as specified by~~ Reference Residential Appendix Section RA3.3 or an approved alternative procedure as specified by Section RA1-; and

I. For small duct high velocity systems the system airflow rate shall be greater than or equal to 250 cfm per ton; or

II. For all other air-cooled air conditioner or air-source heat pump systems the system airflow rate shall be greater than or equal to 350 cfm per ton.

**EXCEPTION to Section 150.1(c)7Aib:** Standard ducted systems without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in TABLE-150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Section RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 150.0(m)12DC for the system air filter device(s) shall conform to the requirements given in TABLES 150.0-B and 150.0-C.

c. The installer shall charge the system according to manufacturer's specifications. Refrigerant charge shall be verified according to one of the following options, as applicable:

I. The installer and rater shall perform the standard charge procedure as specified by Reference Residential Appendix Section RA3.2.2 or an approved alternative procedure as specified by Section RA1; or

II. The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2; or

III. The installer shall perform the weigh-in charging procedure as specified by Reference Residential Appendix Section RA3.2.3.1 provided the system is of a type that can be verified using the Section RA3.2.2 standard charge verification procedure and Section RA3.3 airflow rate verification procedure or approved alternatives in Section RA1. The HERS Rater shall verify the charge using RA3.2.2 and RA3.3 or approved alternatives in Section RA1.

~~**EXCEPTION to Section 150.1(c)7Aia:** Systems that cannot conform to the specifications for hole location in Reference Residential Appendix Figure RA3.2-1, shall not be required to provide holes as described in Figure RA3.2-1.~~

~~**EXCEPTION 1 to Section 150.1(c)7Aib:** The Executive Director may approve alternate airflow rate requirements for small duct high velocity systems.~~

**EXCEPTION 1 to Section 150.1(c)7Aic:** When the outdoor temperature is less than 55°~~degrees~~F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1 to verify the refrigerant charge, the installer may elect to utilize the HERS Rater verification procedure in Reference Residential Appendix Section RA3.2.3.2. If the HERS Rater verification procedure in Section RA3.2.3.2 is used for compliance, the system's thermostat shall conform to the specifications in ~~Reference Joint Appendix JA5~~Section 110.12. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.1(c)7Aib.

ii. Air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted packaged systems, small duct high-velocity systems and mini-split systems, which are of a type that cannot comply with the requirements of Section 150.1(c)7Ai shall comply with subsections a and b, as applicable.

   a. The installer shall confirm the refrigerant charge using the weigh-in charging procedure specified in Reference Residential Appendix Section RA3.2.3.1, as verified by a HERS Rater according to the procedures specified in Reference Residential Appendix Section RA3.2.3.2; and

   b. Systems that utilize forced air ducts shall comply with the minimum system airflow rate requirement in Section 150.1(c)7Aib provided the system is of a type that can be verified using the procedures in Section RA3.3 or an approved alternative procedure in Section RA1.

**EXCEPTION to Section 150.1(c)7A:** Packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installation that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.1(c)7Aib, provided that the system is of a type that can be verified using the procedure specified in Section RA3.3 or an approved alternative in Section RA1.

**CHANGE SIGNIFICANCE:** A requirement for SDHV system airflow rate was added to this section and the section was reorganized accordingly. Section 150.1(c)7AibI was added for the SDHV airflow rate requirement, and Section 150.1(c)7AibII was added for the airflow rate requirement of all other systems. With the addition of the airflow requirements to this section, Exception 1 to Section 150.1(c)7Aib in the 2016 Energy Code allowing SDHV airflow rates to be approved by the Executive Director was no longer necessary and was removed.

Reorganization of the 2019 Energy Code demand response measures required the reference to Reference Joint Appendix JA5 (JA5) in Exception 1 to Section 150.1(c)7Aic to be changed to reference Section 110.12. The 2016 Energy Code demand response requirements were reorganized into a new section, Section 110.12, in the 2019 Energy Code. This new section also directs users to the requirements in JA5 when applicable. Exceptions were also relocated to their appropriate sections, rather than at the end of the parent section.

# 150.1(c)8

## Prescriptive Standards – Domestic Water Heating

**CHANGE TYPE:** Clarification, Addition, and Modification

**CHANGE SUMMARY:** Changes were made to the residential water heating prescriptive options to reflect changes at the federal level and to allow a prescriptive all-electric pathway for residential buildings.

**2019 CODE:**

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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:

[…]

8. **Domestic Water-Heating Systems.** Water-heating systems shall meet the requirements of ~~either~~ A, B, or C. For recirculation distribution systems serving individual dwelling unit, only Demand Recirculation Systems with manual on/off control pumps as specified in the Reference Appendix RA4.4.9 shall be used:

   A. For systems serving individual dwelling units, the water heating system shall meet the requirement of ~~either~~ i, ii, ~~or~~ iii, iv, or v:

      i. ~~A single~~One or more gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank~~, and that meets the requirements of Sections 110.1 and 110.3 shall be installed.~~ .

      ii. A single gas or propane storage-type water heater with an input of 75,000 Btu per hour or less, rated volume less than or equal to 55 gallons and that meets the requirements of Sections 110.1 and 110.3. The dwelling unit shall have installed fenestration products with a weighted average *U*-factor no greater than 0.24, and in addition one of the following shall be installed:

         a. A compact hot water distribution system that is field verified as specified in the Reference Appendix RA4.4.16; or

         b. A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.

      ~~ii. A single gas or propane storage type water heater with an input of 105,000 Btu per hour or less, rated volume less than or equal to 55 gallons and that meets the requirements of Sections 110.1 and 110.3. The dwelling unit shall meet all of the requirements for Quality Insulation Installation (QII) as specified in the Reference Appendix RA3.5, and in addition one of the following shall be installed:~~

~~a. A compact hot water distribution system that is field verified as specified in the Reference Appendix RA4.4.16; or~~

~~b. All domestic hot water piping shall be insulated and field verified as specified in the Reference Appendix RA4.4.1, RA4.4.3 and RA4.4.14.~~

iii. A single gas or propane storage type water heater with an input of ~~105~~75,000 Btu per hour or less, rated volume of more than 55 gallons.~~, and that meets the requirements of Sections 110.1 and 110.3, and in addition one of the following shall be installed:~~

~~a. A compact hot water distribution system that is field verified as specified in the Reference Appendix RA4.4.16; or~~

~~b. All domestic hot water piping shall be insulated and field verified as specified in the Reference Appendix RA4.4.1, RA4.4.3 and RA4.4.14.~~

iv. A single heat pump water heater. The storage tank shall be located in the garage or conditioned space. In addition, one of the following:

a. A compact hot water distribution system as specified in the Reference Appendix RA4.4.6 and a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9. ~~or~~

b. For Climate Zones 2 through 15, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14. ~~or~~

c. For Climate Zones 1 and 16, a photovoltaic system capacity of 1.1 kWdc larger than the requirement specified in Section 150.1(c)14.

v. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher. The storage tank shall be located in the garage or conditioned space. In addition, for Climate Zones 1 and 16, a photovoltaic system capacity of 0.3 kWdc larger than the requirement specified in Section 150.1(c)14 or a compact hot water distribution system as specified in the Reference Appendix RA4.4.6.

B. For systems serving multiple dwelling units, a central water-heating system that includes the following components shall be installed:

i. Gas or propane ~~water heaters, boilers or other~~ water heating ~~equipment~~system. ~~that meet the minimum efficiency requirements of Sections 110.1 and 110.3; and~~

ii. A ~~water heating~~ recirculation ~~loop~~ system that meets the requirements of Sections 110.3(c)2 and 110.3(c)5, includes two or more separate recirculation loops serving separate dwelling units, and is ~~equipped with an~~

~~automatic control system that~~capable of automatically controll~~ings~~ 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 150.1(c)8~~C~~Bii:** Buildings with eight or fewer dwelling units ~~are exempt from the requirement for two recirculation loops~~may use a single recirculation loop.

iii. A solar water-heating system meeting the installation criteria specified in Reference Residential Appendix RA4 and with a minimum solar savings fraction of either a or b: ~~of 0.20 in Climate Zones 1 through 9 or a minimum solar savings fraction of in Climate Zones 10 through 16. The solar savings fraction shall be determined using a calculation method approved by the Commission~~.

a. 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.

b. A minimum solar savings fraction of 0.15 in Climate Zones 1 through 9 or a minimum solar savings fraction of 0.30 in Climate Zones 10 through 16. In addition, a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.

C. A water-heating system serving multiple dwelling units determined by the Executive Director to use no more energy than the one specified in subsection B.

**CHANGE SIGNIFICANCE:** Section 150.1(c)8Ai – References to Sections 110.1 and 110.3 were removed to reduce redundancy. The requirements of Section 110.1 and 110.3 apply regardless of their inclusion in this section.

Section 150.1(c)8Aii – The 2016 Energy Code prescriptively allowed a storage water heater less than or equal to 55 gallons to be installed when Quality Insulation Installation (QII) measures were met, along with other energy efficient options. QII is now a prescriptive requirement for all newly constructed low-rise residential buildings under the 2019 Energy Code. As a result of this, new alternatives were added which when combined with a storage water heater of 55 gallons or less, equating to the same level of energy savings as an instantaneous water heater that satisfies the requirements of Option i.

Section 150.1(c)8Aiii – The US Department of Energy now requires that residential gas storage water heaters with a volume greater than 55 gallons meet the efficiency levels of condensing type water heaters. These water heaters are as efficient as meeting Option i, and for this reason, all additional requirements have been removed for these water heaters.

Section 150.1(c)8iv – The purpose of adding this section is to add an option to meet the water heating prescriptive requirement by installing an electric heat pump water heater, with either additional photovoltaic system capacity, or with both compact hot water distribution and Drain Water Heat Recovery systems. The 2019 Energy Code added all-electric

compliance options for low-rise residential buildings, and this section and the next were introduced to give flexibility to the prescriptive options without changing the stringency of the current requirements.

Section 150.1(c)8Av – The purpose of adding this section is to add an option to meet the water heating prescriptive requirement by installing an electric heat pump water heater that meets the requirement of Northwest Energy Efficiency Alliance (NEEA) Advanced Water Heater Specification Tier 3 or higher. Heat pump water heaters meeting this efficiency requirement do not have to install any additional features unless they are installed in the colder climate zones of California in Climate Zones 1 and 16.

Section 150.1(c)8Bi and Bii – The purpose of the changes to these sections is to simplify code language and reduce redundancy.

Section 150.1(c)8Biii – The purpose of the change in this section is to add an option for central water heating systems to meet a reduced solar savings fraction requirement by using Drain Water Heat Recovery devices. This change is necessary to add flexibility to the prescriptive options without changing the stringency of the current requirements.

Section 150.1(c)8C – This section was added for consistency with a similar provision in Section 150.2(a)1Diii. These changes are necessary to ensure the availability of electric prescriptive options for newly constructed residential buildings which may be approved in between code cycles (e.g., central heat pump water heaters).

# 150.1(c)10

## Prescriptive Standards – Central Fan Integrated Ventilation Systems

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Residential gas furnace air-handler fan efficacy was increased from 0.58 W/cfm to 0.45 W/cfm for units manufactured on or after July 3, 2019.

**2019 CODE:**

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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:

[…]

10. **Central Fan Integrated Ventilation Systems.** Central forced air system fans used to provide outside air, shall have an air-handling unit fan efficacy less than or equal to the maximum W/CFM specified in A or B. The airflow rate and fan efficacy requirements in this section shall be confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix RA3.3. Central Fan Integrated Ventilation Systems shall be certified to the Energy Commission as Intermittent Ventilation Systems as specified in Reference Residential Appendix RA3.7.4.2.

    A. 0.45 W/CFM for gas furnace air-handling units; or

    B. 0.58 W/CFM for air-handling units that are not gas furnaces.

    **EXCEPTION to Section 151.0(c)10A:** Gas furnace air-handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value 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.

    ~~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. Central Fan Integrated Ventilation Systems shall be certified to the Energy Commission as Intermittent Ventilation Systems as specified in Reference Residential Appendix RA3.7.4.2.~~

**CHANGE SIGNIFICANCE:** The US Department of Energy has established minimum efficiency requirements for residential furnace fans. These regulations require residential furnace fans manufactured on or after July 3, 2019, to provide a minimum efficiency equivalent to constant torque brushless permanent magnet (BPM) type motors used in multistaged furnaces. As a result of this, the Energy Code has increased the fan efficacy requirements for gas furnace air handlers from 0.58 W/cfm to 0.45 W/cfm, while the fan efficacy for all other air-handlers remains at 0.58 W/cfm. As a result of these changes, this section was reorganized to reflect

the change with the addition of Section 150.1(c)10A for gas furnace air-handler fan efficacy and the addition of Section 150.1(c)10B for all other air-handlers.

The fan efficacy of central fan integrated (CFI) systems must be verified using the same methods as required for furnaces and air handlers (see Reference Residential Appendix RA3.3). The central system air handler must be operating in ventilation mode with the outdoor air damper open and with ventilation air flowing into the return plenum from outside the building. Furthermore, the airflow that must be measured is the total airflow through the air handler (system airflow), which is the sum of the return airflow, and the outside air ducted to the return plenum (ventilation airflow).

An exception to Section 151.0(c)10A was also added to allow gas furnace air-handling units manufactured prior to July 3, 2019, to comply with a fan efficacy value less than or equal to 0.58 w/cfm instead of 0.45 W/cfm. The exception is necessary to avoid the possibility that manufacturer inventory would be stranded and unable to comply with the new 0.45 W/cfm standard.

# 150.1(c)12

## Prescriptive Standards – Ventilation Cooling

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** These changes clarify the flow rate and free attic vent area requirements for ventilation cooling whole house fans.

**2019 CODE:**

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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:

[…]

12. **Ventilation Cooling.** Single family homes shall comply with the Whole-house fan ~~House Fan~~ (WHF) requirements shown in TABLE 150.1-A. When a WHF is required, comply with Subsections A. through C. below:

    A. Have installed one or more WHFs whose total Air Flow CFM ~~as listed in the CEC Directory is at least~~ is equal to or greater than 1.5 CFM/ft$^2$ of conditioned floor area. Airflow CFM for WHF's shall be determined based on the Airflow listed in the Energy Commission's database of certified appliances, which is available at www.energy.ca.gov/appliances/database; and

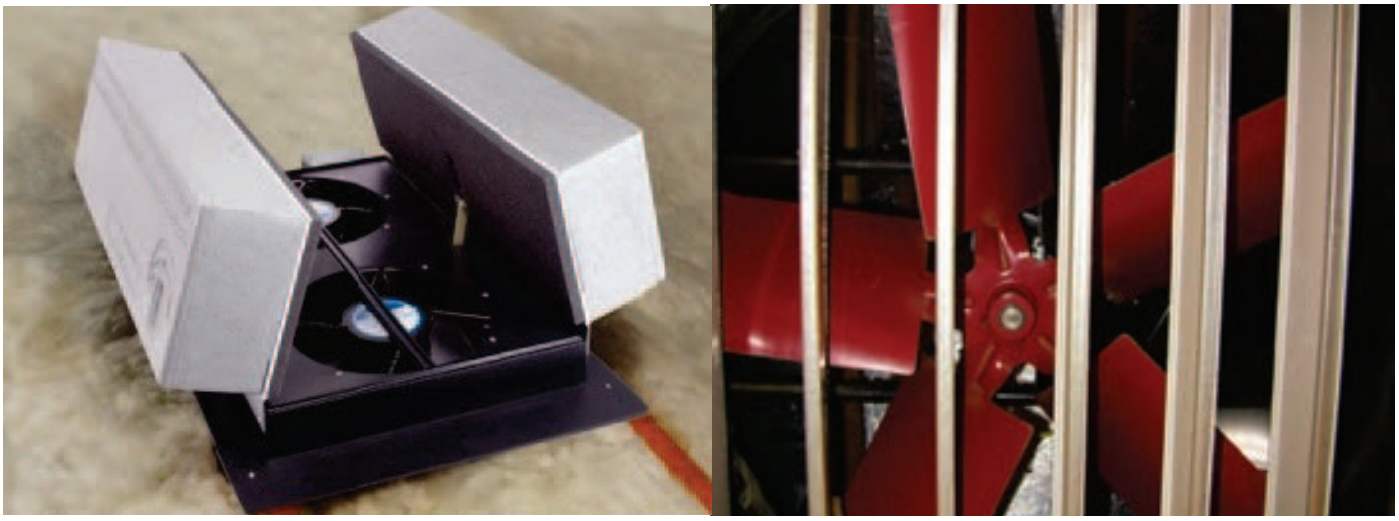
    B. Have at least 1 square foot of attic vent free area for each 750 CFM of rated whole-house fan Airflow~~Air Flow~~ CFM, or if the manufacturer has specified a greater free vent area, the manufacturers' free vent area specifications; and

    **EXCEPTION to Section 150.1(c)12B:** WHFs that are directly vented to the outside.

    C. Provide homeowners who have WHFs with a one page "How to operate your whole-house fan" informational sheet.

**CHANGE SIGNIFICANCE:** Language was added to this section that clarifies how to determine the minimum required airflow rate of whole house fans (WHF). The minimum required airflow rate of 1.5 CFM/ft$^2$ of conditioned floor area must be determined by using the listed WHF airflow CFM listed in the Energy Commission's Modernized Appliance Efficiency Database System (MAEDbS), also known as the Title 20 database.

An exception to the minimum attic vent free area was also added. Homes with WHFs that are directly vented to the outside (instead of venting into the attic) are not required to meet the free attic vent area requirement.



Whole House Fans – These fans are an excellent way to reduce the temperature of a home in climates where there are large differences between daytime and morning/evening temperatures. Whole house fans are a prescriptive requirement for newly constructed single family low-rise residential buildings in Climate Zones 8–14.
Source: California Energy Commission, 2019 Residential Compliance Manual

# 150.1(c)14

## Prescriptive Standards – Photovoltaic Requirements

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** A new measure requiring photovoltaic systems for all newly constructed low-rise residential buildings was added.

**2019 CODE:**

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B. In TABLE 150.1-A and TABLE 150.1-B, NA (not allowed) means that feature is not permitted in a particular Climate Zone and 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:

[…]

14. **Photovoltaic Requirements.** All low-rise residential buildings shall have a photovoltaic (PV) system meeting the minimum qualification requirements as specified in Joint Appendix JA11, with annual electrical output equal to or greater than the dwelling's annual electrical usage as determined by Equation 150.1-C:

EQUATION 150.1-C ANNUAL PHOTOVOLTAIC ELECTRICAL OUTPUT

$kW_{PV} = (CFA \times A)/1000 + (NDwell \times B)$

where:

$kW_{PV}$ = kWdc size of the PV system

CFA = Conditioned floor area

NDwell = Number of dwelling units

A = Adjustment factor from Table 150.1-C

B = Dwelling adjustment factor from Table 150.1-C

**EXCEPTION 1 to Section 150.1(c)14:** No PV system is required if the effective annual solar access is restricted to less than 80 contiguous square feet by shading from existing permanent natural or manmade barriers external to the dwelling, including but not limited to trees, hills, and adjacent structures. The effective annual solar access shall be 70 percent or greater of the output of an unshaded PV array on an annual basis.

**EXCEPTION 2 to Section 150.1(c)14:** In climate zone 15, the PV system size shall be the smaller of a size that can be accommodated by the effective annual solar access or a PV system size required by the Equation 150.1-C, but no less than 1.5 Watt DC per square foot of conditioned floor area.

**EXCEPTION 3 to Section 150.1(c)14:** In all climate zones, for dwelling units with two habitable stories, the PV system size shall be the smaller of a size that can be accommodated by the effective annual solar access or a PV system size required by the Equation 150.1-C, but no less than 1.0 Watt DC per square foot of conditioned floor area

**EXCEPTION 4 to Section 150.1(c)14:** In all climate zones, for low-rise residential dwellings with three habitable stories and single-family dwellings with three or more habitable stories, the PV system size shall be the smaller of a size that can be accommodated by the effective annual solar access or the PV system size required by the Equation 150.1-C, but no less than 0.8 Watt DC per square foot of conditioned floor area.

**EXCEPTION 5 to Section 150.1(c)14:** For a dwelling unit plan that is approved by the planning department prior to January 1, 2020 with available solar ready zone between 80 and 200 square feet, the PV system size is limited to the lesser of the size that can be accommodated by the effective annual solar access or the size that is required by the Equation 150.1-C.

**EXCEPTION 6 to Section 150.1(c)14:** PV system sizes from Equation 150.1-C may be reduced by 25 percent if installed in conjunction with a battery storage system. The battery storage system shall meet the qualification requirements specified in Joint Appendix JA12 and have a minimum capacity of 7.5 kWh.

**TABLE 150.1-C CFA and Dwelling Adjustment Factors**

| Climate Zone | A - CFA | B - Dwelling Units |
|---|---|---|
| 1 | 0.793 | 1.27 |
| 2 | 0.621 | 1.22 |
| 3 | 0.628 | 1.12 |
| 4 | 0.586 | 1.21 |
| 5 | 0.585 | 1.06 |
| 6 | 0.594 | 1.23 |
| 7 | 0.572 | 1.15 |
| 8 | 0.586 | 1.37 |
| 9 | 0.613 | 1.36 |
| 10 | 0.627 | 1.41 |
| 11 | 0.836 | 1.44 |
| 12 | 0.613 | 1.40 |
| 13 | 0.894 | 1.51 |
| 14 | 0.741 | 1.26 |
| 15 | 1.56 | 1.47 |
| 16 | 0.59 | 1.22 |

**CHANGE SIGNIFICANCE:** 150.1(c)14 – The purpose of the addition of this section is to add a prescriptive requirement for installation of a photovoltaic (PV) system that has an annual electrical output equal to the dwelling's annual electrical usage, not including any electricity for space heating or water heating. This means that any electricity used for

water heating or space heating will not count towards the required PV system size. The primary reason for this was that the Commission did not want to disincentivize all-electric homes. There were concerns during the rulemaking process that if electrifying a building would mean more PV system generation would be required, then builders may decide to forgo constructing all-electric buildings. Net Energy Metering rules also played a factor in this decision. Builders can still size their PV system to offset all electric loads, including water heating and space heating, but the Energy Code will not require bigger systems to offset the electric consumption of those components. Additionally, an increased PV system size is not allowed to be traded off for decreased building component efficiencies.

This requirement is applicable to all newly constructed low-rise residential buildings, including single family buildings, and multifamily buildings with 3 habitable stories or less, unless an exception is met. Additions and alterations to existing low-rise residential buildings are not subject to the PV system requirements of the Energy Code.

The size of the PV system required to comply with the Energy Code varies depending on the building's conditioned floor area, number of dwelling units, and climate zone. Bigger homes require bigger cooling systems (assuming they're in a cooling-dependent climate), and have bigger plug loads to offset. With regards to cooling, the PV system size will vary drastically depending on climate. Homes in hotter climate zones will have higher cooling loads than those in cooler climates, and the size of the PV system needed will vary as a result. Equation 150.1-C calculates the minimum PV system size requirement for a home complying via the prescriptive approach.

When demonstrating compliance via the performance approach, an approved computer modeling program must be used to determine the necessary PV system size needed to satisfy the requirements of the Energy Code. For example, a building with a highly efficient envelope will require less cooling, and in turn will require a smaller PV system compared to a building designed with a poor building envelope.

This is the first time the Energy Code has required energy generation. Previous iterations have included credits for PV systems. This change is necessary to continue to pursue the State's goals relating to greenhouse gas emission reductions and combatting climate change.

Exception 1 to Section 150.1(c)14 exempts buildings from the PV system requirements if the effective annual solar access is restricted to less than 80 contiguous square feet. For example, buildings where excessive shading exists like trees, or adjacent structures, that would make adding a PV system no longer meet cost-effective requirements are exempt from the PV system requirements.

Exception 2 to Section 150.1(c)14 allows a reduction of the PV system size required in Climate Zone 15 when the effective annual solar access is too restrictive to meet the calculated required PV system size. This exception limits the installed PV system size to no less than 1.5 Watts DC per square foot of conditioned floor area.

Exception 3 to Section 150.1(c)14 allows a reduction of the PV system size required for dwelling units with two habitable stories. This allows

the system size to be the smaller of what can be accommodated by the effective annual solar access, or what the equation requires. This exception limits the installed PV system size to no less than 1.0 Watts DC per $ft^2$ of conditioned floor area.

Exception 4 to Section 150.1(c)14 allows a reduction in size of the PV system needed for compliance for buildings with three habitable stories, and single family buildings with three or more habitable stories. This allows the system size to be the smaller of what can be accommodated by the effective annual solar access, or what the equation requires. This exception limits the installed PV system size to no less than 0.8 Watts DC per square foot of conditioned floor area.

Exception 5 to Section 150.1(c)14 allows a reduction in PV size for dwelling unit plans that were approved by planning departments prior to January 1, 2020, with solar ready zones between 80 and 200 square feet. In these scenarios the PV size can be the smaller of what the equation requires, or the size that can be accommodated by the effective annual solar access.

Exception 6 to Section 150.1(c)14 allows a reduction in PV system size by 25 percent if a battery storage system is installed. The minimum capacity of the battery system installed for compliance with this exception is 7.5kWh. The qualification requirements for the installed battery system can be found in Reference Joint Appendix JA12.

Solar Panels Installed on a Low-Rise Residential Building – Solar photovoltaic systems are prescriptively required for all newly constructed low-rise residential buildings under the 2019 Energy Code.
Source: California Energy Commission

Getty Images

PV System Shading Exception – Buildings with an effective annual solar access that is restricted to less than 80 contiguous square feet due to external shading are exempt from the PV system requirements of the Energy Code.

# Table 150.1-A

## Prescriptive Standards — Single Family Standard Building Design

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** Efficiency measures were increased, and multifamily requirements were separated from single-family buildings, leaving Table 150.1-A strictly for single-family buildings.

**2019 CODE:**

**TABLE 150.1-A Component Package—Single-Family Standard Building Design**

| SINGLE FAMILY | | CLIMATE ZONE | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| | | Building Envelope Insulation | | | | | | | | | | | | | | | |
| Building Envelope | Roofs/Ceilings | Below Roof Deck Insulation[1,2] (With Air Space) | NR | NR | NR | R-19 | NR | NR | NR | R-19 | R-19 | R-19 | R-19 | R-19 | R-19 | R-19 | R-19 | R-19 |
| | | Ceiling Insulation | R-38 | R-38 | R-30 | R-38 | R-30 | R-30 | R-30 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 |
| | | Radiant Barrier | NR | REQ | REQ | NR | REQ | REQ | REQ | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Option B (meets 150.1(c)9A) | Ceiling Insulation | R-38 | R-30 | R-30 | R-30 | R-30 | R-30 | R-30 | R-30 | R-30 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 |
| | Option C (meets 150.1(c)9B) | Radiant Barrier | NR | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | NR |
| | Walls Above Grade | Framed [3] | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.065 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 | U 0.048 |
| | | Mass Wall Interior [4,5] | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.059 R-17 |
| | | Mass Wall Exterior [4,5] | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.125 R-8.0 | U 0.077 R-13 |
| | Below Grade | Below Grade Interior [6] | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.077 R-13 | U 0.067 R-15 |
| | | Below Grade Exterior [8] | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.200 R-5.0 | U 0.100 R-10 | U 0.100 R-10 | U 0.053 R-19 |
| | Floors | Slab Perimeter | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | U 0.58 R-7.0 |
| | | Raised Concrete Raised | U 0.037 R-19 U 0.092 R-8.0 | U 0.037 R-19 U 0.092 R-8.0 | U 0.037 R-19 U 0.269 R-0 | U 0.037 R-19 U 0.269 R-0 | U 0.037 R-19 U 0.269 R-0 | U 0.037 R-19 U 0.269 R-0 | U 0.037 R-19 U 0.269 R-0 | U 0.037 R-19 U 0.269 R-0 | U 0.037 R-19 U 0.269 R-0 | U 0.037 R-19 U 0.269 R-0 | U 0.037 R-19 U 0.092 R-8.0 | U 0.037 R-19 U 0.138 R-4.0 | U 0.037 R-19 U 0.092 R-8.0 | U 0.037 R-19 U 0.092 R-8.0 | U 0.037 R-19 U 0.138 R-4.0 | U 0.037 R-19 U 0.092 R-8.0 |
| | Quality Insulation Installation (QII) | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Roofing Products | Steep-sloped | Aged Solar Reflectance | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | 0.63 | NR | 0.63 | NR |
| | | Thermal Emittance | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | 0.75 | NR | 0.75 | NR |
| | Low-sloped | 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 |
| Fenestration | Maximum U-factor | | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| | Maximum SHGC | | NR | 0.23 | NR | 0.23 | NR | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 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 | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | NR |
| Door | Maximum U-factor | | 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 |

## TABLE 150.1-A Component Package—Single-Family Standard Building Design—continued

| | SINGLE FAMILY | CLIMATE ZONE | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| | | Building Envelope Insulation | | | | | | | | | | | | | | | |
| HVAC-SYSTEM | Space Heating[9] Electric-Resistance allowed If gas, AFUE | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN |
| | If Heat Pump, HSPF7 | 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 |
| | Refrigerant Charge Verification or Fault Indicator Display | NR | REQ | NR | NR | NR | NR | NR | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | NR |
| | Whole House Fan8 | NR | NR | NR | NR | NR | NR | REQ | REQ | REQ | REQ | REQ | REQ | 0.RE Q | REQ | NR | NR |
| | Central System Air Handlers Central Fan Integrated Ventilation System Fan Efficacy | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ |
| | Ducts[10] Roof/Ceiling Option B Duct Insulation | R-8 | R-8 | R-6 | R-8 | R-6 | R-6 | R-6 | R-8 | R-8 | R-8 | R-8 | R-8 | R-8 | R-8 | R-8 | R-8 |
| | §150.1(c)9A | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | Roof/Ceiling Option C Duct Insulation | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 |
| | §150.1(c)9B | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ |
| WATER-HEATING | All Buildings | System shall meet Section 150.1(c)8 | | | | | | | | | | | | | | | |

1. ~~Install the specified *R*-value with an air space present between the roofing and the roof deck~~, such as standard installation of concrete or clay tile.
2. *R*-values shown for below roof deck insulation are for wood-frame construction with insulation installed between the framing members. Alternatives including insulation above rafters or above roof deck shall comply with the performance standards.
3. Assembly *U*-factors for exterior framed walls can be met with cavity insulation alone or with continuous insulation alone, or with both cavity and continuous insulation that results in an assembly *U*-factor equal to or less than the *U*-factor shown. Use Reference Joint Appendices JA4 Table 4.3.1, 4.3.1(a), or Table 4.3.4 to determine alternative insulation products ~~meet~~ to be less than or equal to the required maximum *U*-factor.
4. Mass wall has a ~~thermal~~ heat capacity greater than or equal to 7.0 Btu/h-ft$^2$. ~~"Interior" denotes insulation installed on the inside surface of the wall.~~
5. "Interior" denotes insulation installed on the inside surface of the wall. "Exterior" denotes insulation installed on the exterior surface of the wall.
6. Below grade "interior" denotes insulation installed on the inside surface of the wall; and below grade "exterior" denotes insulation installed on the outside surface of the wall.
7. HSPF means "heating seasonal performance factor."
8. When whole-house fans are required (REQ), only those whole-house fans that are listed in the Appliance Efficiency Directory may be installed. Compliance requires installation of one or more WHFs whose total airflow CFM is capable of meeting or exceeding a minimum 1.5 cfm/square foot of conditioned floor area as specified by Section 150.1(c)12.
9. 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.
10. For duct and air handler location: REQ denotes location in conditioned space. When the table indicates ducts and air handlers are in conditioned space, a HERS verification is required as specified by Reference Residential Appendix RA3.1.4.3.8.

**CHANGE SIGNIFICANCE:** Table 150.1-A was reformatted and separated from the multifamily low-rise residential requirements. As a result of changes described in the previous change summaries of Section 150.1(c), efficiencies were updated.

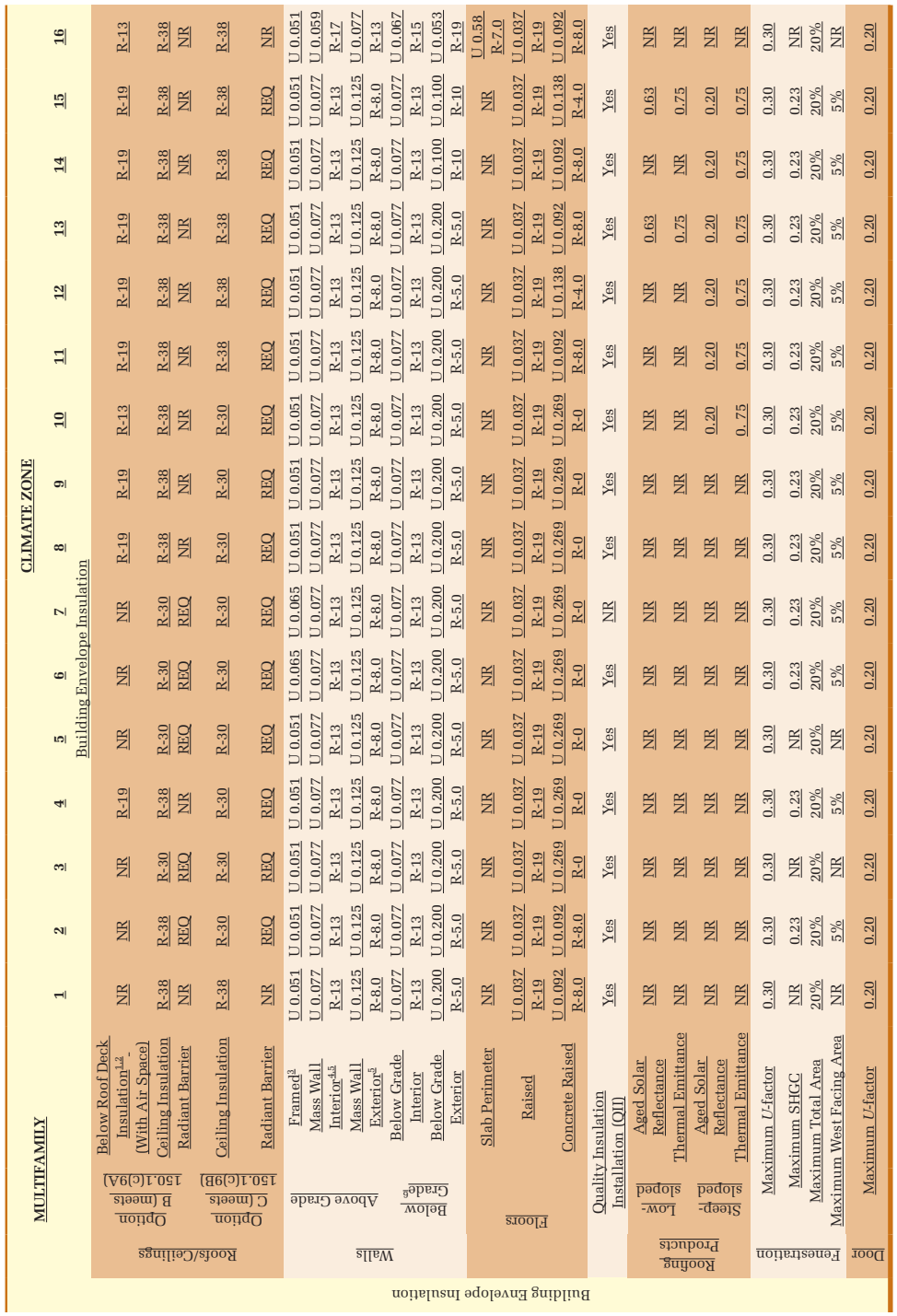
Prescriptively, the option for meeting the high-performance attic requirements without an airspace between the roofing and the roof deck was removed, and the corresponding footnote as removed. Other modifications were made to the footnotes to increase clarity and readability of the Energy Code.

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** Table 150.1-B was created to separate the prescriptive requirements for multifamily buildings from those for single-family buildings.

**2019 CODE:**

**TABLE 150.1-B Component Package—Multifamily Standard Building Design**



| MULTIFAMILY | | CLIMATE ZONE | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Building Envelope Insulation | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Roofs/Ceilings | Below Roof Deck Insulation[1,2] - (With Air Space) | NR | NR | NR | R-19 | NR | NR | NR | R-19 | R-19 | R-13 | R-19 | R-19 | R-19 | R-19 | R-19 | R-13 |
| | Ceiling Insulation | R-38 | R-38 | R-30 | R-38 | R-30 | R-30 | R-30 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 |
| | Radiant Barrier | NR | REQ | REQ | NR | REQ | REQ | REQ | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| Option C (meets 150.1(c)9B) | Ceiling Insulation | R-38 | R-30 | R-30 | R-30 | R-30 | R-30 | R-30 | R-30 | R-30 | R-30 | R-38 | R-38 | R-38 | R-38 | R-38 | R-38 |
| Option B (meets 150.1(c)9A) | Radiant Barrier | NR | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | NR |
| Walls | Framed[3] | U 0.051 | U 0.051 | U 0.051 | U 0.051 | U 0.051 | U 0.065 | U 0.065 | U 0.051 | U 0.051 | U 0.051 | U 0.051 | U 0.051 | U 0.051 | U 0.051 | U 0.051 | U 0.051 |
| Above Grade | Mass Wall Interior[4,5] | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.059 |
| | | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-17 |
| | Mass Wall Exterior[5] | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.125 | U 0.077 |
| | | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-8.0 | R-13 |
| Below Grade[6] | Below Grade Interior | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.077 | U 0.067 |
| | | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-13 | R-15 |
| | Below Grade Exterior | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.200 | U 0.100 | U 0.100 | U 0.053 |
| | | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-5.0 | R-10 | R-10 | R-19 |
| Floors | Slab Perimeter | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | U 0.58 R-7.0 |
| | Raised | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 | U 0.037 R-19 |
| | Concrete Raised | U 0.092 R-8.0 | U 0.092 R-8.0 | U 0.269 R-0 | U 0.269 R-0 | U 0.269 R-0 | U 0.269 R-0 | U 0.269 R-0 | U 0.269 R-0 | U 0.269 R-0 | U 0.269 R-0 | U 0.092 R-8.0 | U 0.138 R-4.0 | U 0.092 R-8.0 | U 0.092 R-8.0 | U 0.138 R-4.0 | U 0.092 R-8.0 |
| Quality Insulation Installation (QII) | | Yes | Yes | Yes | Yes | Yes | Yes | NR | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Roofing Products | Aged Solar Reflectance | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | 0.63 | NR | 0.63 | NR |
| Low-sloped | Thermal Emittance | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | 0.75 | NR | 0.75 | NR |
| Steep-sloped | 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 |
| Fenestration | Maximum *U*-factor | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| | Maximum SHGC | NR | 0.23 | NR | 0.23 | NR | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 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 | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | NR |
| Door | Maximum *U*-factor | 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 |

# Table 150.1-B

## Prescriptive Standards — Multifamily Standard Building Design

## TABLE 150.1-B Component Package—Multifamily Standard Building Design—continued

| Multifamily | | CLIMATE ZONE | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| | | Building Envelope Insulation | | | | | | | | | | | | | | | |
| Space Heating[a] | Electric-Resistance allowed<br>If gas, AFUE | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN | No MIN |
| | If Heat Pump, HSPF[2] | 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 |
| | Refrigerant Charge Verification or Fault Indicator Display | NR | REQ | NR | NR | NR | NR | NR | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | NR |
| HVAC-SYSTEM | Central System Air Handlers | | | | | | | | | | | | | | | | |
| | Central Fan Integrated Ventilation System Fan Efficacy | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ |
| Ducts[a] | Roof/Ceiling, Option B<br>Duct Insulation | R-8 | R-8 | R- 6 | R-8 | R- 6 | R- 6 | R- 6 | R-8 | R-8 | R-8 | R-8 | R-8 | R-8 | R-8 | R-8 | R-8 |
| | §150.1(c)9A | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | Roof/Ceiling, Option C<br>Duct Insulation | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R-6 | R- 6 | R-6 | R-6 | R- 6 | R- 6 | R- 6 |
| | §150.1(c)9B | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ | REQ |
| WATER-HEATING | All Buildings | System shall meet Section 150.1(c)8 | | | | | | | | | | | | | | | |

1. Install the specified *R*-value with an air space present between the roofing and the roof deck. Such as standard installation of concrete or clay tile.
2. *R*-values shown for below roof deck insulation are for wood-frame construction with insulation installed between the framing members. Alternatives including insulation above rafters or above roof deck shall comply with the performance standards.
3. Assembly *U*-factors for exterior framed walls can be met with cavity insulation alone or with continuous insulation alone, or with both cavity and continuous insulation that results in an assembly *U*-factor equal to or less than the *U*-factor shown. Use Reference Joint Appendices JA4 Table 4.3.1, 4.3.1(a), or Table 4.3.4 to determine alternative insulation products to be less than or equal to the required maximum *U*-factor.
4. Mass wall has a heat capacity greater than or equal to 7.0 Btu/h-ft$^2$.
5. "Interior" denotes insulation installed on the inside surface of the wall. "Exterior" denotes insulation installed on the exterior surface of the wall.
6. Below grade "interior" denotes insulation installed on the inside surface of the wall, and below grade "exterior" denotes insulation installed on the outside surface of the wall.
7. HSPF means "heating seasonal performance factor."
8. 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.
9. For duct and air handler location: REQ denotes location in conditioned space. When the table indicates ducts and air handlers are in conditioned space, a HERS verification is required as specified by Reference Residential Appendix RA3.1.4.3.8.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402, 25402.1, and 25605, Public Resources Code. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, 25605, and 25943, Public Resources Code.

**CHANGE SIGNIFICANCE:** Table 150.1-B was created to isolate the low-rise multifamily prescriptive requirements. This was done because some requirements did not meet all requirements necessary for them to apply to both single-family and multifamily buildings.

For multifamily buildings it was found that the HERS verified measure for Quality Insulation Installation (QII) was not cost-effective for multifamily buildings in Climate Zone 7. For this reason, climate zone 7 has no QII requirement for low-rise multifamily buildings.

Similarly, the 2019 Energy Code's prescriptive baseline for high-performance walls for low-rise multifamily buildings remains the same as the 2016 Energy Code. This means wall assembly *U*-factors (0.051) for these multifamily buildings will be equivalent 2 × 6 wood framed walls with R-19 cavity insulation, and R-5 continuous insulation in all climate zones except 6 and 7. Single family walls assume R-21 cavity insulation.

The whole house fan ventilation cooling requirement was only applicable to single-family buildings in previous code cycles, and this continues with the 2019 Code. As a result, Table 150.1-B does not have a row for whole house fans.

PART 9

# Low-Rise Residential Buildings—Additions and Alterations to Existing Low-Rise Residential Buildings

## Subchapter 9

Subchapter 9 is comprised solely of Section 150.2. This section identifies which other sections of the Energy Code apply to additions and alterations to existing low-rise residential buildings. It also identifies specific variances from the previous sections of the Energy Code for additions and alterations to these buildings and systems. All requirements for additions and alterations to these existing buildings are defined within Section 150.2, and this section references other applicable sections of the Energy Code depending on the scope of work. ■

**150.2**

**Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings**

**150.2(a)**

**Additions**

**150.2(a) EXCEPTION 1**

**Additions, Dwelling Unit Ventilation Exception**

**150.2(a) EXCEPTION 7**

**Additions, Photovoltaic System Exception**

**150.2(a) NOTE**

**Additions**

**150.2(a)1A**

**Prescriptive Approach, Additions Greater Than 700 ft$^2$**

**150.2(a)1C**

**Prescriptive Approach, Mechanical Ventilation for Indoor Air Quality**

**150.2(a)1D**

**Prescriptive Approach, Water Heater**

**150.2(a)2C**

**Performance Approach, Mechanical Ventilation for Indoor Air Quality**

**150.2(b)**

**Alterations**

**150.2(b)1B**

**Prescriptive Approach, Replacement Fenestration**

**150.2(b)1C**

**Prescriptive Approach Entirely New or Complete Replacement Space-Conditioning Systems**

**150.2(b)1D**

**Prescriptive Approach, Altered Duct Systems – Duct Sealing**

**150.2(b)1E**

**Prescriptive Approach Altered Space-Conditioning System – Duct Sealing**

**150.2(b)1F**

**Prescriptive Approach Altered Space-Conditioning System – Mechanical Cooling**

**150.2(b)1G**

**Alterations, Prescriptive Approach, Altered Space-Conditioning System**

**150.2(b)1H**

**Prescriptive Approach, Water Heating System**

**150.2(b)1I**

**Prescriptive Approach, Roofs**

**150.2(b)1J**

**Prescriptive Approach, Lighting**

**150.2(b)2**

**Performance Approach**

**150.2(b)2A**

**Performance Approach, Altered Components**

# 150.2(a) Exception 1

## Additions, Dwelling Unit Ventilation Exception

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** The language in Exception 1 was changed to align with the changes made to low-rise residential indoor air quality (IAQ) requirements found in Section 150.0(o)1.

**2019 CODE:**

(a) **Additions.** Additions to existing low-rise residential buildings shall meet the requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (q), 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 the ~~ASHRAE Standard 62.2 Section 4~~ requirements to provide ~~whole-building~~dwelling unit mechanical ventilation airflow as ~~referenced~~ specified by Section 150.0(o)1C, 150.0(o)1E, or 150.0(o)1F; however all other applicable requirements ~~of ASHRAE Standard 62.2 as referenced~~ specified by Section 150.0(o) shall be met by the addition.

**CHANGE SIGNIFICANCE:** The 2019 Energy Code incorporates the requirements of ASHRAE 62.2, in total, except for specific deviations that have been added to Section 150.0(o)1. The reference to ASHRAE 62.2 was removed and replaced with specific Energy Code sections in Section 150.0(o)1. This change maintains the exemption for additions of 1,000 square feet or less from ventilation airflow requirements while eliminating exemptions from other IAQ requirements in Section 150.0(o) and ASHRAE 62.2 such as filtration and kitchen range hood requirements.

The reference to "whole building" in the 2016 Energy Code was changed to "dwelling unit" in the 2019 Energy code. This change is needed to maintain consistency with ASHRAE 62.2 terminology.

It is important to note that new dwelling units, regardless of size, are now subject to the mandatory whole building ventilation requirements, as described in the new Section, 150.2(a)1C.

# 150.2(a) Exception 7

## Additions, Photovoltaic System Exception

**CHANGE TYPE:** Addition

**CHANGE SUMMARY:** An exception was added to exclude residential additions from the photovoltaic system requirements of the Energy Code.

**2019 CODE:**

(a) **Additions.** Additions to existing low-rise residential buildings shall meet the requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (q), and either Section 150.2(a)1 or 2.

[…]

**EXCEPTION 7 to Section 150.2(a):** Photovoltaic systems, as specified in Section 150.1(c)14, are not required for additions.

**CHANGE SIGNIFICANCE:** An exception was added to exclude additions to low-rise residential buildings from the photovoltaic (PV) system requirements of the 2019 Energy Code. The PV system requirements only apply to newly constructed low-rise residential buildings.

# 150.2(a) Note

## Additions

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** A note about changes of occupancy was removed because it was deemed to be unnecessary.

**2019 CODE:**

(a) **Additions.** Additions to existing low-rise residential buildings shall meet the requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (q), and either Section 150.2(a)1 or 2.

[…]

~~**NOTE:** For alterations that change the occupancy classification of the building, the requirements specified in Section 150.2(b) apply to the occupancy after the alterations.~~

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to remove an explanatory note that did not possess any regulatory effect. The occupancy type, by definition, is what determines which requirements apply. This note was not necessary, and this change clarifies without materially altering the requirements of the Energy Code.

Changes of occupancy alone do not trigger code requirements, but if components are altered as part of that change of occupancy, those components are subject to the alteration requirements of the Energy Code. Similarly, if part of the change of occupancy increases the building's conditioned floor area and conditioned volume, that is subject to the requirements for additions. While a change of occupancy alone does not trigger requirements, meeting indoor air quality requirements is strongly recommended.

# 150.2(a)1A

## Prescriptive Approach, Additions Greater Than 700 ft²

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** The prescriptive requirements for additions greater than 700 square feet were updated to increase efficiency and clarify when specific requirements are triggered.

**2019 CODE:**

(a) **Additions.** Additions to existing low-rise residential buildings shall meet the requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (q), and either Section 150.2(a)1 or 2.

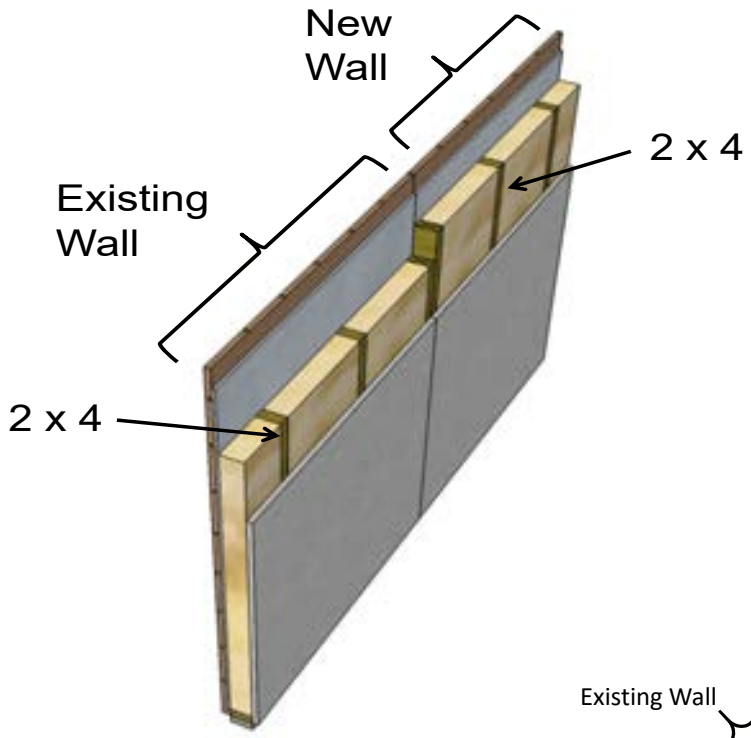
[…]

1. **Prescriptive approach.** Additions to existing buildings shall meet the following additional requirements:
   A. Additions that are greater than 700 square feet shall meet the ~~prescriptive~~ requirements of Section 150.1(c), ~~except~~with the following modifications:
      i. Extensions of existing wood-framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2 × 4 framing and R-~~19~~21 in a 2 × 6 framing.
      ii. The maximum allowed fenestration area shall be the greater of 175 square feet or 20 percent of the addition floor area, and the maximum allowed west-facing fenestration area shall be the greater of 70 square feet or the requirements of Section 150.1(c).
      iii. When existing siding of a wood-framed wall is not being removed or replaced, cavity insulation of R-15 in a 2 × 4 framing and R-21 in a 2 × 6 framing shall be installed and continuous insulation is not required.
      iv. Additions that consist of the conversion of existing spaces from unconditioned to conditioned space shall not be required to perform the following as part of QII:
         a. Existing window and door headers shall not be required to be insulated.
         b. Air sealing shall not be required when the existing air barrier is not being removed or replaced.

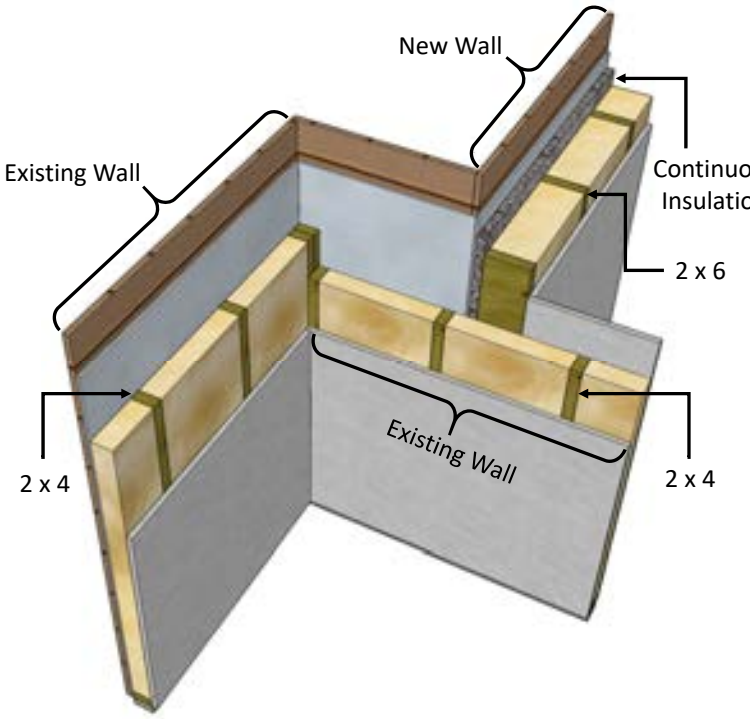
**CHANGE SIGNIFICANCE:** Section 150.2(a)1Ai – The purpose of the change to this section is to require R-21 cavity insulation in a 2 × 6 wall extension. This change is necessary to provide consistency with the move towards higher efficiency wall systems. Wall extensions do not require continuous insulation.

Section 150.2(a)1Aiii – This section was added to require R-15 insulation in existing 2 × 4 wall cavities, and R-21 in existing 2 × 6 cavities for additions in which the existing exterior siding is neither being replaced or removed. This change is necessary to provide a compliance pathway for additions involving the conversion of previously unconditioned space to conditioned space.

Section 150.2(a)1Aiv – The purpose of the addition is to clarify additions that consist of the conversion of existing spaces from unconditioned to conditioned space shall not be required to meet the window and door header insulation requirements relating to, and that air sealing shall not be required, when the existing air barrier is not being removed. These are measures related to HERS verified Quality Insulation Installation, which is now applicable for low-rise residential additions over 700 square feet.




Wall Extension – Extensions of walls in additions can retain existing framing dimensions. In a 2 × 4 wall extension, the cavity must have R-15 insulation.
Source: Hamed Amouzgar, California Energy Commission, Blueprint Newsletter, Issue 118




Not A Wall Extension – In this example, the new wall extends perpendicular from an existing wall. This is not a wall extension and is subject to more stringent requirements.
Source: Hamed Amouzgar, California Energy Commission, Blueprint Newsletter, Issue 118

# 150.2(a)1C

## Additions, Prescriptive Approach, Mechanical Ventilation for Indoor Air Quality

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** The changes to this section clarify code section applicability and ventilation rate calculation requirements for additions larger than 1,000 square feet, and add ventilation requirements for new dwelling units that are additions, regardless of size.

**2019 CODE:**

(a) **Additions.** Additions to existing low-rise residential buildings shall meet the requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (q), and either Section 150.2(a)1 or 2.

[…]

1. **Prescriptive approach.** Additions to existing buildings shall meet the following additional requirements:

   […]

   C. **Mechanical Ventilation for Indoor Air Quality.**

      i. Additions ~~larger~~ to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by more than 1,000 square feet shall ~~meet the ASHRAE Standard 62.2 Section 4 requirement to provide~~have ~~whole-building~~ mechanical ventilation airflow in accordance with Sections 150.0(o)1C, 150.0(o)1E, or 150.0(o)1F as applicable. The ~~whole-building~~ mechanical ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit comprised of the existing dwelling unit conditioned floor area plus the addition conditioned floor area.

      ii. New dwelling units that are additions to an existing building shall have mechanical ventilation airflow provided in accordance with Sections 150.0(o)1C, 150.0(o)1E, or 150.0(o)1F as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the new dwelling unit.

**CHANGE SIGNIFICANCE:** The 2019 Energy Code incorporates the requirements of ASHRAE 62.2, in total, except for specific deviations that have been added to Section 150.0(o)1. The reference to ASHRAE 62.2 was removed and replaced with specific Energy Code sections to ensure that the deviations from ASHRAE 62.2 are applied to additions.

The changes to this section establish separate requirements for additions to existing dwelling units and completely new dwelling unit additions to existing buildings under the prescriptive approach. For additions to existing dwelling units, the addition must be larger than 1,000 square feet for the ventilation rates of Sections 150.0(o)1C, 150.0(o)1E, or 150.0(o)1F to be applicable. For new dwelling units added to an existing building, like accessory dwelling units (ADUs), the ventilation

requirements of Sections 150.0(o)1C, 150.0(o)1E, or 150.0(o)1F are applicable regardless of the size of the new dwelling unit.

In both cases, the whole building ventilation rate is based on the entire dwelling unit's conditioned floor area, and all sections of Section 150.0(o) are applicable. Also, all sections of ASHRAE 62.2 are applicable where the Energy Code Section 150.0(o)1 does not deviate from ASHRAE 62.2.

Accessory Dwelling Unit – An accessory dwelling unit that shares a common wall with an existing structure on a residential site is considered an addition.
Source: Elizabeth Ferris, California Energy Commission, Blueprint Newsletter, Issue 122

# 150.2(a)1D

## Additions, Prescriptive Approach, Water Heater

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** Water heater language was simplified and updated to reflect changes in referenced sections of the 2019 Energy Code.

**2019 CODE:**

(a) **Additions.** Additions to existing low-rise residential buildings shall meet the requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (q), and either Section 150.2(a)1 or 2.

[…]

1. **Prescriptive approach.** Additions to existing buildings shall meet the following additional requirements:

   […]

   D. **Water Heater.** When a second water heater is installed as part of the addition, one of the following types of water heaters shall be installed ~~and assumed to comply~~:

      i. A ~~natural gas or propane~~ water-heating system that meets the requirements of Section 150.1(c)8; or

      ~~ii. If no natural gas is connected to the building, an electric water heater that has an energy factor equal to or greater than required under the Appliance Efficiency Regulations. For recirculation distribution systems, only Demand Recirculation Systems with manual control pumps as specified in the Reference Appendix RA4.4 shall be used; or~~

      ii~~ii~~. A water-heating system determined by the Executive Director to use no more energy than the one specified in Item ~~1~~ i. ~~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~~

      ~~iv. Using the existing building plus addition compliance or addition alone compliance as defined in Section 150.2(a)2 demonstrate that the proposed water heating system uses no more energy than the system defined in Item 1 above regardless of the type or number of water heaters installed.~~

**CHANGE SIGNIFICANCE:** Section 150.2(a)1Di – The purpose of the change to this section is to remove the phrase "natural gas or propane," because the prescriptive options under Section 150.1(c)8 of the 2019 Energy Code now include water heating systems other than natural gas or propane. This change clarifies without materially altering the requirements of the Energy Code.

Sections 150.2(a)1Dii and iii – The purpose of the changes to these sections is to remove provisions that related to natural gas availability. This change is necessary to accommodate electrification of existing buildings

and for consistency with proposed options for newly constructed buildings. If a new water heater is installed to serve an addition, it is subject to the prescriptive requirements for newly constructed buildings found in Section 150.1(c)8. Note that if a water heater is replaced as part of an addition, that replacement of the water heater is considered an alteration and is subject to the alteration requirements of Section 150.2(b)1H of the 2019 Energy Code.

Section 150.2(a)1Div – The purpose of removing this section is to eliminate redundant and potentially confusing language. The option specified in this section is a performance approach and is not a prescriptive requirement. As such, this section is redundant with Section 150.2(b)2. This change clarifies without materially altering the requirements of the Energy Code.

# 150.2(a)2C

## Additions, Performance Approach, Mechanical Ventilation for Indoor Air Quality

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** The changes to this section clarify code section applicability and ventilation rate calculation requirements for additions larger than 1,000 square feet and add ventilation requirements for new dwelling units that are additions, regardless of size.

**2019 CODE:**

(a) **Additions.** Additions to existing low-rise residential buildings shall meet the requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (q), and either Section 150.2(a)1 or 2.

[…]

2. **Performance approach.** Performance calculations shall meet the requirements of Section 150.1(a) through (c), pursuant to the applicable requirements in Items A, B, and C below.

[…]

C. **Mechanical Ventilation for Indoor Air Quality.**

i. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by more ~~larger~~ than 1,000 square feet shall ~~meet the ASHRAE Standard 62.2 Section 4 requirement to provide~~ have ~~whole-building~~ mechanical ventilation airflow in accordance with Section 150.0(o)1C, 150.0(o)1E, or 150.0(o)1F as applicable. The ~~whole-building~~ mechanical ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit comprised of the existing dwelling unit conditioned floor area plus the addition conditioned floor area.

ii. New dwelling units that are additions to an existing building shall have mechanical ventilation airflow provided in accordance with Section 150.0(o)1C, 150.0(o)1E, or 150.0(o)1F as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the new dwelling unit.

**CHANGE SIGNIFICANCE:** The 2019 Energy Code incorporates the requirements of ASHRAE 62.2, in total, except for specific deviations that have been added to Section 150.0(o)1. The reference to ASHRAE 62.2 was removed and replaced with specific Energy Code sections to ensure the deviations from ASHRAE 62.2 are applied to additions.

The changes to this section establish separate requirements for additions to existing dwelling units and completely new dwelling unit additions to existing buildings under the performance approach. For additions to existing dwelling units, the addition must be larger than 1,000 square feet for the ventilation rates of Sections 150.0(o)1C, 150.0(o)1E, or 150.0(o)1F to be applicable. For new dwelling units added to an existing building, like accessory dwelling units, the requirements of Sections 150.0(o)1C, 150.0(o)1E, or 150.0(o)1F are applicable regardless of the size of the new dwelling unit.

In both cases, the whole building ventilation rate is based on the entire dwelling unit conditioned floor area and all sections of Section 150.0(o) are applicable. Also, all sections of ASHRAE 62.2 are applicable where the Energy Code Section 150.0(o)1 does not deviate from ASHRAE 62.2.

Accessory Dwelling Unit – Existing detached unconditioned structures (like garages) that are converted into accessory dwelling units are considered additions. Source: Elizabeth Ferris, California Energy Commission, Blueprint Newsletter, Issue 122

# 150.2(b)1B

## Alterations, Prescriptive Approach, Replacement Fenestration

**CHANGE TYPE:** Clarification

**CHANGE SUMMARY:** Language pertaining to fenestration alterations was reworked to provide consistency in phrasing for replacement fenestration in alteration projects.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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 110.9 and all applicable requirements of Sections 150.0(a) through (l), 150.0(m)1 through 150.0 (m)10, and Section 150.0(o) through (q); and

[…]

B. **Replacement Fenestration.** ~~Replacement of fenestration, where existing fenestration area in an existing wall or roof is replaced with a new manufactured fenestration product and up to the total fenestration area removed in the existing wall or roof, the replaced~~New manufactured fenestration products installed to replace existing fenestration products of the same total area shall meet the U-factor and Solar Heat Gain Coefficient requirements of Sections 150.1(c)3A, and 150.1(c)4.

**EXCEPTION 1 to Section 150.2(b)1B:** Replacement of vertical fenestration no greater than 75 square feet with a *U*-factor no greater than 0.40 in Climate Zones 1–16, and a SHGC value no greater than 0.35 in Climate Zones 2, 4, and 6–~~16~~5.

**EXCEPTION 2 to Section 150.2(b)1B:** Replaced skylights must meet a *U*-factor no greater than 0.55, and a SHGC value no greater than 0.30.

**NOTE:** Glass replaced in an existing sash and frame or ~~replacement of~~ sashes replaced in an existing frame are considered repairs, provided that the replacement is at least equivalent to the original in performance.

**CHANGE SIGNIFICANCE:** This language was restructured to better capture which fenestration alterations are subject to the replacement fenestration requirements. The intent is to have the replacement fenestration requirements of Section 150.2(b)1B only apply to new fenestration installed in existing openings. Increasing the size of the opening, or creating a new opening, is not considered "replacement fenestration." In that scenario, the new fenestration is subject to the requirements of Section 150.2(b)1A of the 2019 Energy Code.

*Getty Images*

Replacement Windows – New manufactured fenestration products installed to replace existing fenestration products of the same size are subject to the fenestration replacement requirements of Section 150.2(b)1B of the 2019 Energy Code.

# 150.2(b)1C

## Alterations, Prescriptive Approach, Entirely New or Complete Replacement Space-Conditioning Systems

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** Section references were updated, and an exception was added to prescriptively allow the switch from gas space conditioning systems to heat pumps.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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 110.9 and all applicable requirements of Section 150.0(a) through (l); 150.0(m)1 through 150.0 (m)10, Section 150.0(o) through (q); and

   […]

   C. **Entirely New or Complete Replacement Space-Conditioning Systems** installed as part of an alteration, shall include all the system heating or cooling equipment, including but not limited to condensing unit and cooling or heating coil for split systems; or complete replacement of a package unit; plus entirely new or replacement duct system (Section 150.2(b)1Diia); plus a new or replacement air handler.

   Entirely ~~N~~new or complete 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)1 through 150.0(m)10; 150.0(m)12; 150.0(m)13, 150.1(c)6, 150.1(c)7, and 150.1(c)10, and ~~Table~~ TABLE 150.2-A; 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.~~

   **EXCEPTION to Section 150.2(b)1Cii:** When the fuel type of the replaced heating system was natural gas or liquefied petroleum gas, the new or complete replacement space-conditioning system may be a heat pump.

**CHANGE SIGNIFICANCE:** A reference to the duct leakage testing requirements of Section 150.0(m)11 was removed from this section for new or complete replacements of space conditioning systems. Removal of the reference eliminates conflicting requirements found in the duct alteration, Section 150.2(b)1D. Section 150.2(b)1D specifies the requirements for altered duct systems and duct sealing which deviate from the requirements of Section 150.0(m)11. Section 150.0(m)11 is only applicable to newly installed duct systems in new construction.

Language requiring TDV equivalent systems when changing fuel types was also removed. This language is already addressed via the performance approach, and this correctly separates the prescriptive and performance methods of compliance. TDV Energy use is only determined

using the approved computer modeling programs with the performance compliance approach.

Lastly, an exception was added to allow electrification projects to use the prescriptive method of compliance to switch from gas space conditioning systems to electric heat pumps.

# 150.2(b)1D

## Alterations, Prescriptive Approach, Altered Duct Systems – Duct Sealing

**CHANGE TYPE:** Addition and Modification

**CHANGE SUMMARY:** Duct sealing requirements were added for ducts and space conditioning components located inside garages and requirements for multifamily duct sealing were also added.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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 110.9 and all applicable requirements of Section 150.0(a) through (l); 150.0(m)1 through 150.0 (m)10, Section 150.0(o) through (q); and

   […]

   D. **Altered Duct Systems – Duct Sealing:** In all Climate Zones, when more than 40 feet of new or replacement space-conditioning system ducts are installed, the ducts shall comply with the applicable requirements of subsections i and ii below.: ~~-~~Additionally, when altered ducts, air-handling units, cooling or heating coils, or plenums are located in garage spaces, the system shall comply with subsection 150.2(b)1Diic regardless of the length of any new or replacement space-conditioning ducts installed in the garage space.

      i. New ducts located in unconditioned space shall meet the applicable requirements of Sections 150.0(m)1 through 150.0(m)11, and the duct insulation requirements of TABLE 150.2-A; and

**TABLE 150.2-A Duct Insulation *R*-Value**

| Climate Zone | 1 through 10, 12&13 | 11, 14 through 16 |
|---|---|---|
| Duct *R*-Value | R-6 | R-8 |

      ii. The altered duct system, regardless of location, 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 Section RA3.1, utilizing the leakage compliance criteria specified in ~~Reference Residential Appendix TABLE RA3.1-2, and conforming to either~~ Subsection a or b below.:

         a. **Entirely New or Complete Replacement Duct System.** If the new ducts form an entirely new or complete replacement duct system directly connected to

the air handler, the duct system shall meet one of the following requirements:

I. For single-family dwellings, the measured duct leakage shall be equal to or less than 5 percent of 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.

II. For multifamily dwellings, regardless of duct system location,

A. The total leakage of the duct system shall not exceed 12 percent of the nominal system air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1, or

B. The duct system leakage to outside shall not exceed 6 percent of the nominal system air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4.

Entirely new or complete replacement duct systems installed as part of an alteration shall be constructed of at least 75 percent new duct material, and up to 25 percent may consist of reused parts from the dwelling unit's existing duct system, including but not limited to registers, grilles, boots, air handler, coil, plenums, duct material; if the reused parts are accessible and can be sealed to prevent leakage.

Entirely new or complete replacement duct systems shall also conform to the requirements of Sections 150.0(m)12 and 150.0(m)13.

b. **Extension of an Existing Duct System.** If the new ducts are an extension of an existing duct system serving single-family or multifamily dwellings, the combined new and existing duct system shall meet one of the following requirements:

~~1~~I. The measured duct leakage shall be equal to or less than 15 percent of nominal 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; or

~~2~~II. The measured duct leakage to outside shall be equal to or less than 10 percent of nominal system 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

~~3~~III. If it is not possible to meet the duct sealing requirements of either Section 150.2(b)1DiibI~~1~~, or 150.2(b)1DiibII~~2~~, 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)1Diib: Duct Sealing.** Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos.

c. **Altered Ducts and Duct System Components in Garage Spaces.** When new or replacement space-conditioning ducts, air-handling units, cooling or heating coils, or plenums are located in a garage space, compliance with either I or II below is required.

I. The measured system duct leakage shall be less than or equal to 6 percent of system air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1, or

II. All accessible leaks located in the garage space 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.

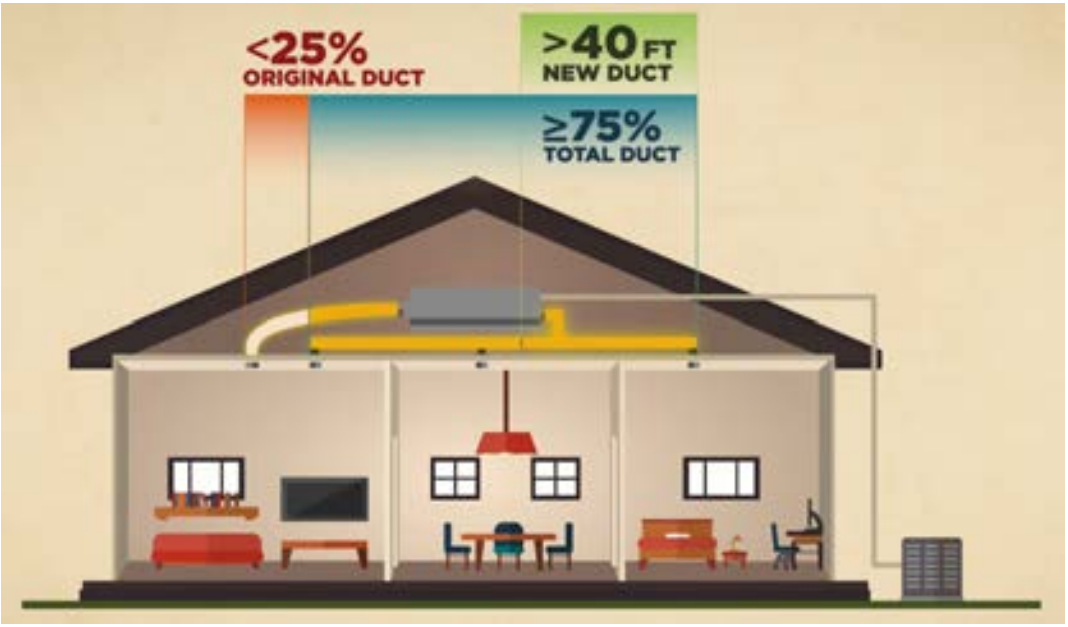
**CHANGE SIGNIFICANCE:** There are two main changes to this section. Duct sealing requirements for components located in garages were added, as well as multifamily duct sealing requirements. The duct sealing requirements in this section are only applicable when the duct system is altered. For duct sealing requirements where the duct system is not altered but other space conditioning system components are altered, see Section 150.2(b)1E.

When ducts of any length are altered and any space conditioning system components (such as ducts of any length, coils, air handlers, or plenums) are located inside a garage space, special duct sealing protocols now apply. This aligns the Energy Code with the requirements of ASHRAE 62.2. Duct sealing compliance for these alterations can be shown by a duct leakage test in accordance with the procedure in Reference Residential Appendices Section RA3.1.4.3.1 with a duct leakage of 6 percent or less. If this maximum duct leakage target cannot be met, a smoke test can be performed in accordance with the procedure in Reference Residential Appendices Section RA3.1.4.3.5, and all accessible leaks in the garage must be sealed. Note that the smoke test procedure in Reference Appendices Section RA3.1.4.3.5 requires a leak test to be performed before the smoke test is performed. These tests must be verified by a HERS rater.

The 2016 Energy Code references Table RA3.1-2 in the Reference Residential Appendices for duct leakage requirements for entirely new or complete replacement of the duct system. The 2019 Energy Code has since been simplified by incorporating the leakage requirements for entirely new or replacement duct systems into Section 150.2(b)1Da and eliminating the reference to Table RA3.1-2 in the Reference Residential

Appendices. Section 150.2(b)1Diia now has leakage requirements for single-family and multifamily dwellings separated into two new paragraphs.

The duct leakage requirements for the extension of existing ducts are the same for single-family and multifamily dwellings. Language has been added to Section 150.2(b)1Diib to clarify that the requirements apply to both occupancies.




Duct Alteration Triggers – If more than 40 linear feet of new or replacement space-conditioning ducts are installed, then duct leakage testing and prescriptive insulation requirements are required. When 75 percent or more of the duct system is replaced, this is considered a complete replacement of the duct system, which has more stringent requirements as described in Section 150.2(b)1Diia of the Energy Code.
Source: California Energy Commission

# 150.2(b)1E

## Alterations, Prescriptive Approach, Altered Space-Conditioning System – Duct Sealing

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Duct sealing requirements were added for alterations of space conditioning system components located inside garages.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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 110.9 and all applicable requirements of Section 150.0(a) through (l); 150.0(m)1 through 150.0 (m)10, Section 150.0(o) through (q); and

   […]

   E. **Altered Sspace-Cconditioning Ssystem—Dduct Ssealing.:** In all Climate Zones, when a space-conditioning system serving a single-family or multifamily dwelling is altered by the installation or replacement of space-conditioning system equipment, including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil, the duct system that is connected to the 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 Reference Residential Appendix RA3.1 and the leakage compliance criteria specified in Subsection i, ii, or iii below. Additionally, when altered ducts, air-handling units, cooling or heating coils, or plenums are located in garage spaces, the system shall comply with Section 150.2(b)1Diic regardless of the length of any new or replacement space-conditioning ducts installed in the garage space. ~~Reference Residential Appendix Table RA3.1-2, conforming to one of the following requirements:~~

   i. The measured duct leakage shall be equal to or less than 15 percent of system 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 equal to or less than 10 percent of system air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4; or

   iii. If it is not possible to meet the duct sealing requirements of either Section 150.2(b)1Ei or Section 150.2(b)1Eii, 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 Section RA3.1.4.3.5.

   **EXCEPTION 1 to Section 150.2(b)1E: Duct Ssealing.** 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 RA3.1.

**EXCEPTION 2 to Section 150.2(b)1E: Duct ~~S~~sealing.** Duct systems with less than 40 linear feet as determined by visual inspection.

**EXCEPTION 3 to Section 150.2(b)1E: Duct ~~S~~sealing.** Existing duct systems constructed, insulated or sealed with asbestos.

**CHANGE SIGNIFICANCE:** Duct sealing requirements for alterations to components located in garages were added to the 2019 Energy Code. The duct leakage requirements in this section apply when space conditioning components are altered and do not apply when the duct system is altered. For alterations that include duct system alterations see Section 150.2(b)1D.

When altered space conditioning components such as coils, air handlers or plenums are located inside a garage space, special protocols for duct leakage for the ducts connected to these components now apply and can be found in Section 150.2(b)1Diic of the Energy Code.

Duct sealing compliance for alterations (not including those with components in garages) can be shown by a total duct leakage test in accordance with the procedure in Reference Residential Appendices Section RA3.1.4.3.1 with a duct leakage of 15 percent or less. Alternatively, a duct leakage to the outdoors test may be performed in accordance with the procedure in Reference Residential Appendices Section RA3.1.4.3.4 with a duct leakage of 10 percent or less. If these duct leakage requirements cannot be met, a smoke test in accordance with the procedure in Reference Residential Appendices Section RA3.1.4.3.5 can be performed and all accessible leaks in the garage must be sealed. These tests must be verified by a HERS rater.

Language was also added to clarify that the requirements apply to both single-family and multifamily occupancies.

# 150.2(b)1F

## Alterations, Prescriptive Approach, Altered Space-Conditioning System – Mechanical Cooling

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** The purpose of this change is to separately identify airflow rate requirements for Small Duct High Velocity (SDHV) systems that supply space cooling from other types of air-cooled air conditioners and air-source heat pumps.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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 110.9 and all applicable requirements of Section 150.0(a) through (l); 150.0(m)1 through 150.0 (m)10, Section 150.0(o) through (q); and

   […]

   F. **Altered Sspace-Cconditioning Ssystem—Mmechanical Ccooling.:** 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, the altered system shall comply with the following requirements:

      […]

      ii. In Climate Zones 2, 8, 9, 10, 11, 12, 13, 14, and 15, air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted package systems, small duct high velocity air systems, and minisplit systems, shall comply with Subsections a and b, unless the system is of a type that cannot be verified using the specified procedures. Systems that cannot comply with the requirements of Section 150.2(b)1Fii shall comply with Section 150.2(b)1Fiii.

      **EXCEPTION to Section 150.2(b)1Fii:** Entirely new or complete replacement packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installation that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the

charge. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.2(b)1Fiia, provided that the system is of a type that can be verified using the procedure specified in RA3.3 or an approved alternative in RA1.

a. Minimum system airflow rate shall comply with the applicable Subsection I or II below as confirmed through field verification and diagnostic testing in accordance with ~~greater than or equal to 300 cfm per ton shall be demonstrated by the installer and be verified by the HERS Rater according to~~ the procedures specified in Reference Residential Appendix Section RA3.3 or an approved alternative procedure as specified in Section RA1.~~;~~

   I. Small duct high-velocity systems shall demonstrate a minimum system airflow rate greater than or equal to 250 cfm per ton of nominal cooling capacity; or

   II. All other air-cooled air conditioner or air-source heat pump systems shall demonstrate a minimum system airflow rate greater than or equal to 300 cfm per ton of nominal cooling capacity; and

   **EXCEPTION 1 to Section 150.2(b)1Fiia:** Systems unable to comply with the minimum ~~300 cfm per ton~~ airflow rate requirement shall demonstrate compliance using the procedures in Section RA3.3.3.1.5; and the system's thermostat shall conform to the specifications in ~~Reference Joint Appendix JA5~~Section 110.12.

   **EXCEPTION 2 to Section 150.2(b)Fiia:** Entirely new or complete replacement space conditioning systems, as specified by section 150.2(b)1C, without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in TABLE-150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Section RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 150.0(m)12C for the system air filter device(s) shall conform to the requirements given in TABLES 150.0-B and 150.0-C.

b. The installer shall charge the system according to manufacturer's specifications. Refrigerant charge shall be verified according to one of the following options, as applicable.

   I. The installer and rater shall perform the standard charge verification procedure as specified in Reference Residential Appendix Section RA3.2.2, or an approved alternative procedure as specified in Section RA1; or

II. The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2; or

III. The installer shall perform the weigh-in charging procedure as specified by Reference Residential Appendix Section RA3.2.3.1 provided the system is of a type that can be verified using the RA3.2.2 standard charge verification procedure and RA3.3 airflow rate verification procedure or approved alternatives in RA1. The HERS Rater shall verify the charge using RA3.2.2 and RA3.3 or approved alternatives in RA1.

~~**EXCEPTION 1 to Section 150.2(b)1Fiia:** Systems unable to comply with the minimum 300 cfm per ton airflow rate requirement shall demonstrate compliance using the procedures in Section RA3.3.3.1.5; and the system's thermostat shall conform to the specifications in Reference Joint Appendix JA5Section 110.12.~~

~~**EXCEPTION 2 to Section 150.2(b)1Fiia:** The Executive Director may approve alternate airflow and fan efficacy requirements for small duct high velocity systems.~~

~~**EXCEPTION 32 to Section 150.2(b)Fiia:** Entirely new or complete replacement space conditioning systems, as specified by section 150.2(b)1C, without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in TABLE-150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Section RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 150.0(m)12C for the system air filter device(s) shall conform to the requirements given in TABLES 150.0-B and 150.0-C.~~

~~**EXCEPTION 1 to Section 150.2(b)1Fiib:** When the outdoor temperature is less than 55° degrees F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1to demonstrate compliance, the installer may elect to utilize the HERS Rater verification procedure in Reference Residential Appendix Section RA3.2.3.2. If the HERS Rater verification procedure in Section RA3.2.3.2 is used for compliance, the system's thermostat shall conform to the specifications in Reference Joint Appendix JA5Section 110.12. Ducted systems shall comply with~~

~~the minimum system airflow rate requirements in Section 150.2(b)1Fiia.~~

~~**EXCEPTION to Section 150.2(b)1Fii:** Entirely new or complete replacement packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installation that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.2(b)1Fiia, provided that the system is of a type that can be verified using the procedure specified in RA3.3 or an approved alternative in RA1.~~

iii. In climate Zones 2, 8, 9, 10, 11, 12, 13, 14, and 15, air-cooled air conditioners or air-source heat pumps, including but not limited to ducted split systems, ducted package systems, small duct high-velocity, and minisplit systems, which are of a type that cannot comply with the requirements of 150.2(b)1Fiib shall comply with subsections a and b, as applicable.

a. The installer shall confirm the refrigerant charge using the weigh-in charging procedure specified in Reference Residential Appendix Section RA3.2.3.1, as verified by a HERS Rater according to the procedures specified in Reference Residential Appendix RA3.2.3.2; and

b. Systems that utilize forced air ducts shall comply with the minimum system airflow rate requirement in Section 150.2(b)1Fiia provided the system is of a type that can be verified using the procedures in Section RA3.3 or an approved alternative procedure in Section RA1.

**EXCEPTION to Section 150.2(b)1Fiii:** Entirely new or complete replacement packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installation that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.2(b)1Fiiib, provided that the system is of a type that can be verified using the procedure specified in Section RA3.3 or an approved alternative in Section RA1.

**CHANGE SIGNIFICANCE:** Airflow requirements for SDHV systems that supply space cooling were added and separated from other air-cooled air conditioner and heat pump airflow requirements. This change clarifies that SDHV systems are categorized separately from other air-sourced air conditioners and heat pumps.

SDHV systems operate differently than other air-cooled air conditioners and heat pumps. For this reason, SDHV systems have a different airflow rate target. The airflow target specified in this change applies to all certified SDHV air conditioners and heat pumps that supply cooling to a space and is consistent with other sections of the Energy Code. This change requires the new SDHV airflow value to be used when performing the SDHV refrigerant charge testing. The exceptions were changed accordingly to reflect the addition of the new airflow rate target for SDHV systems.

The reference in the exceptions for the thermostat to comply with the requirements in Reference Joint Appendix JA5 of the 2019 Reference Appendices was changed to reference Section 110.12 of the 2019 Energy Code instead. The 2019 Energy Code compiled all the requirements for demand response into Section 110.12, and when applicable, Section 110.12 directs users to Reference Joint Appendix JA5.

Exceptions were also relocated to better align them with the sections that they apply to.

# 150.2(b)1G

## Alterations, Prescriptive Approach, Altered Space-Conditioning System

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** Heat pumps are now allowed to replace natural gas or liquefied petroleum gas furnaces prescriptively in alterations.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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 110.9 and all applicable requirements of Section 150.0(a) through (l); 150.0(m)1 through 150.0 (m)10, Section 150.0(o) through (q); and

[…]

G. **Altered Space-Conditioning System.** Replacement space-conditioning systems shall be limited to natural gas, liquefied petroleum gas, or the existing fuel type.

**EXCEPTION to Section 150.2(b)1G:** When the fuel type of the replaced heating system was natural gas or liquefied petroleum gas, the replacement space-conditioning system may be a heat pump.

**CHANGE SIGNIFICANCE:** Adding this new exception allows electrification projects of existing buildings to use the prescriptive method of compliance and guarantees the use of efficient equipment. This change allows the replacement of a natural gas or liquefied petroleum gas furnace with an electric heat pump in an alteration of a space conditioning system.

# 150.2(b)1H

## Alterations, Prescriptive Approach, Water Heating System

**CHANGE TYPE:** Clarification and Addition

**CHANGE SUMMARY:** Language was simplified, and a prescriptive option allowing replacement heat pump water heaters to be installed was added.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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 110.9 and all applicable requirements of Section 150.0(a) through (l); 150.0(m)1 through 150.0 (m)10, Section 150.0(o) through (q); and

   […]

   HG. **Water-Heating System**. Altered or Rreplacement service water-heating systems or components shall meet the applicable requirements below:

   i. **Pipe Insulation.** For newly installed piping, the insulation requirements of Section 150.0(j)2 shall be met. For existing accessible piping the applicable requirements of Section 150.0(j)2Ai, iii, and iv shall be met.

   ii. **Distribution System.** For recirculation distribution systems serving individual dwelling units, only Demand Recirculation Systems with manual on/off control as specified in the Reference Appendix RA4.4.9 shall be installed.

   iii. **Water heating system.** The replacement water heating system shall meet one of the following requirements:

      a. A natural gas or propane water-heating system ~~that meets the requirements of Section 110.1 and 110.3. For recirculation distribution systems, only Demand Recirculation Systems with manual control pumps as specified in the Reference Appendix RA4.4 shall be used;~~ or

      b. For Climate Zones 1 through 15, a single heat pump water heater. The storage tank shall not be located outdoors and be placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10. The water heater shall be installed with a communication interface that meets either the requirements of 110.12(a); or

      c. For Climate Zones 1 through 15, a single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher. The storage tank shall not be located outdoors; or

~~b~~d. If no natural gas is connected to the ~~building~~existing water heater location, ~~an~~ consumer electric water heater; or ~~that meets the requirements of Section 110.1 and 110.3. For electric resistance storage type water heaters, the capacity shall not exceed 60 gallons. For recirculation distribution systems, only Demand Recirculation Systems with manual control pumps as specified in the Reference Appendix RA4.4 shall be used; or~~

~~c~~e. A water-heating system determined by the executive director to use no more energy than the one specified in Item ~~1~~ a above; or if no natural gas is connected to the ~~building~~existing water heater location, a water-heating system determined by the executive director to use no more energy than the one specified in Item d~~2~~ above.; or

~~d. Using the existing building plus addition compliance approach as defined in Section 150.2(b)2 demonstrate that the proposed water heating system uses no more energy than the system defined in Item 1 above regardless of the type or number of water heaters installed.~~

**CHANGE SIGNIFICANCE:** Section 150.2(b)1H – The term "altered" was added to this parent section for consistency within Section 150.2(b).

Section 150.2(b)1Hii – This section was added to consolidate previous sections 150.2(b)1Hiiia and 150.2(b)1Hiiib, and it was reworded for clarity. In addition, this section now specifies that it applies only to recirculation systems serving individual dwelling units, not systems serving multiple dwelling units.

Section 150.2(b)1Hiiia – This language was modified for clarity. References to Sections 110.1 and 110.3 were redundant because of references in its parent section, Section 150.2(b). Also, language pertaining to recirculating systems were moved to 150.2(b)1Hii.

Section 150.2(b)1Hiiib – This section was one of two options introduced to allow a prescriptive compliance pathway for heat pump water heaters (HPWHs) installed in Climate Zones 1–15. The 2019 Energy Code has introduced multiple measures to address and facilitate the electrification of buildings, while as with all measures, meeting cost effectiveness criteria, and establishing technically feasible efficiency targets. This option does not establish a minimum efficiency requirement for HPWHs, but instead has additional installation criteria to ensure the system works efficiently. The water heater must be installed inside the building. This allows installation anywhere within the building, including but not limited to unconditioned spaces (e.g., garage, attic, basement, etc.). Rigid insulation must also be installed at the base of the water heater to limit heat loss to the ground.

Section 150.2(b)1Hiiic – This is the second of two options introduced to allow a prescriptive compliance pathway for HPWHs installed in Climate Zones 1–15. Unlike Section 150.2(b)1Hiiib above, this option has a minimum efficiency requirement for the HPWH, requiring that it be a NEEA Advanced Water Heater Specification Tier 3 or higher. This is consistent with the proposed inclusion of this prescriptive option in Section 150.1(c)8 for newly constructed buildings. These systems were found to be very efficient. Additionally, as with Option b above, the water heater must be installed inside of the building.

HPWHs installed in Climate Zone 16 are much less efficient than other climate zones because of its colder climate. For new construction, prescriptively, HPWHs are allowed in Climate Zone 16 as described in Section 150.1(c)8, but that section requires a compact hot water distribution system, or increased PV capacity. During the rulemaking process it was determined that adding a compact hot water distribution system or PV requirement to a water heater alteration was unfeasible. As with any prescriptive requirement, complying via the performance approach allows these limitations to be traded away for other efficiency measures. HPWHs installed as part of alterations in Climate Zone 16 must demonstrate compliance via the performance approach.

Sections 150.2(b)1Hiiid and e – The 2016 Energy Code prescriptively disallowed replacements of electric water heaters if the building had natural gas connected to it. This created complications when gas was connected for space heating or cooking appliances, but not piped to the water heater location. For this reason, this language was modified to prescriptively allow replacement electric water heaters when the existing fuel type was electric, and when no gas is connected to the existing water heater location. Language pertaining to recirculating systems was also relocated to Section 150.2(b)1Hii.

Section 150.2(b)1Hiiid (removed) – This section was removed to eliminate redundant and potentially confusing language. The option specified in this section is a performance approach to compliance and is not a prescriptive requirement. This is redundant with Section 150.2(b)2.

# 150.2(b)1I

## Alterations, Prescriptive Approach, Roofs

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** This section was modified from H to I, and the roof alteration language was modified for clarity.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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 110.9 and all applicable requirements of Section 150.0(a) through (l); 150.0(m)1 through 150.0 (m)10, Section 150.0(o) through (q); and

   […]

   ~~H~~I. **Roofs.** Replacements of the exterior surface of existing roofs, including adding a new surface layer on top of the existing exterior surface, shall meet the requirements of Section 110.8 and the applicable requirements of Subsections i and ii where more than 50 percent of the roof is being replaced:.

   i. Low-rise residential buildings with steep-sloped roofs. 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.

      **EXCEPTION to~~TO~~ Section 150.2(b)1H~~I~~i:** The following shall be considered equivalent to Subsection i:

      a. Air-space of 1.0 inch (25 mm) is provided between the top of the roof deck to the bottom of the roofing product; or

      b. The installed roofing product has a profile ratio of rise to width of 1 to 5 for 50 percent or greater of the width of the roofing product; or

      c. Existing ducts in the attic are insulated and sealed according to Section 150.1(c)9; or

      d. Buildings with at least R-38 ceiling insulation; or

      e. Buildings with a radiant barrier in the attic meeting the requirements of Section 150.1(c)2; or

      f. Buildings that have no ducts in the attic; or

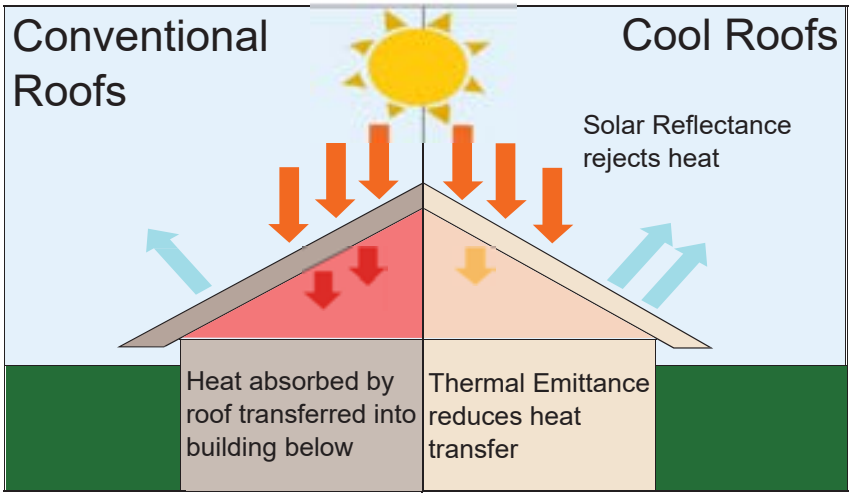
      g. In Climate Zones 10–15, R-2 or greater insulation above the roof deck.

   ii. Low-sloped roofs. In Climate Zones 13 and 15 shall have a 3-year aged solar reflectance equal or greater than 0.63 and a thermal emittance equal or greater than 0.75, or a minimum SRI of 75.

      **EXCEPTION 1 to Section 150.2(b)1H~~I~~ii:** Buildings with no ducts in the attic.

**EXCEPTION 2 to Section 150.2(b)1H<u>I</u>ii:** The aged solar reflectance can be met by using insulation at the roof deck specified in TABLE 150.2-B.

**CHANGE SIGNIFICANCE:** Language pertaining to roofing alterations was modified to directly identify resurfacing of exterior surfaces of existing roofs as roof alterations. This clarifies the intent of the Energy Code and makes this language consistent with that found in the nonresidential roofing alteration requirements in Section 141.0(b)2B of the 2019 Energy Code. Whether replacing the exterior surface of a roof, or overlaying new material, these are treated as alterations, and must meet the applicable requirements of this section.




Solar Reflectance and Thermal Emittance: Solar reflectance rejects heat, while thermal emittance reduces heat transfer.
Source: California Energy Commission

# 150.2(b)1J

## Alterations, Prescriptive Approach, Lighting

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** The alteration requirements for ceiling-recessed luminaires with screw-base sockets was modified for clarity.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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.

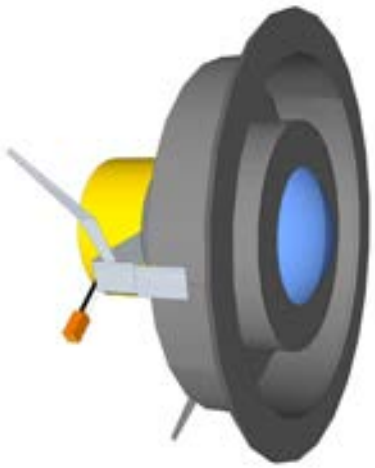
1. **Prescriptive approach.** The altered component and any newly installed equipment serving the alteration shall meet the applicable requirements of Sections 110.0 through 110.9 and all applicable requirements of Section 150.0(a) through (l); 150.0(m)1 through 150.0 (m)10, Section 150.0(o) through (q); and

   […]

   ~~H~~J. **Lighting.** The altered lighting system shall meet the lighting requirements of Section 150.0(k). The altered luminaires shall meet the luminaire efficacy requirements of Section 150.0(k) and TABLE 150.0-A. Where existing screw base sockets are present in ceiling-recessed luminaires, removal of these sockets is not required provided that new JA8-compliant trim kits or lamps designed for use with recessed downlights or luminaires are installed.

**CHANGE SIGNIFICANCE:** The purpose of this change is to clarify that installation of lighting retrofit products into existing ceiling-recessed luminaires with screw base sockets as part of an alteration are not prohibited by the Energy Code.

The existing language could have been understood to require removal of existing screw base sockets, or to prohibit the use of existing screw-base sockets by new retrofit kits. This change was necessary to avoid prohibiting installation of energy efficient devices or require unneeded alteration of existing sockets. This change clarifies without materially altering the requirements of the Energy Code.



LED Trim Kit – In alteration projects, these light sources can be installed into existing ceiling-recessed luminaires with screw base sockets.
Source: Jose Perez, California Energy Commission, Blueprint Newsletter – Issue 122

# 150.2(b)2

## Alterations, Performance Approach

**CHANGE TYPE:** Clarification and Modification

**CHANGE SUMMARY:** This section was rewritten for clarity, and redundant language was removed.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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.

[…]

2. **Performance approach.**

The altered component(s) and any newly installed equipment serving the alteration shall meet the applicable requirements of Subsections A, B, and C below.~~This performance approach shall only be used for projects that include tradeoffs between two or more altered components that are listed in TABLE 150.2-C.~~

**NOTE:** ~~The altered components may be components of the same type, such as a tradeoff between two windows, or components of differing types, such as a tradeoff between a window and an amount of attic insulation.~~

[…]

**CHANGE SIGNIFICANCE:** This language was rewritten to better organize the section's requirements. The note was found to be redundant and an unnecessary clarification, and as a result was removed.

# 150.2(b)2A

## Alterations, Performance Approach, Altered Components

**CHANGE TYPE:** Modification

**CHANGE SUMMARY:** An exception for specific HVAC requirements was reworded and relocated, and this section was restructured for clarity.

**2019 CODE:**

(b) **Alterations.** Alterations to existing low-rise 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.

[…]

2. **Performance approach.**

The altered component(s) and any newly installed equipment serving the alteration shall meet the applicable requirements of Subsections A, B, and C below.~~This performance approach shall only be used for projects that include tradeoffs between two or more altered components that are listed in TABLE 150.2-C.~~

[…]

A. The altered components shall meet the applicable requirements of Sections 110.0 through 110.9, ~~and~~ Sections 150.0(a) through (~~q~~l), Sections 150.0(m)1 through 150.0 (m)10, and Sections 150.0(o) through (q). Entirely new or complete replacement space-conditioning systems, and entirely new or complete replacement duct systems, as these terms are used in Sections 150.2(b)1C, and 150.2(b)1Diia, shall comply with the requirements of Sections 150.0(m)12 and 150.0(m)13.

[…]

~~**EXCEPTION 3 to Section 150.2(b):** Space-Conditioning System Ducts. The requirements of Section150.0(m)12, 150.0(m)13, 150.0(m)14 and 150.0(m)15 are not applicable to Section 150.2(b).~~

**CHANGE SIGNIFICANCE:** The purpose of the change to this section is to incorporate the exception directly into section language by providing a more detailed reference to the applicable portions of Section 150.0(m) for certain space-conditioning system alterations. This change identifies which systems must meet the applicable requirements and reduces some of the need to review other sections to understand its applicability.