

# REVISION RECORD FOR THE STATE OF CALIFORNIA

## ERRATA

January 1, 2020

### 2019 Title 24, Part 6, California Energy Code

#### General Information:

1. The date of this erratum is for identification purposes only. See the History Note Appendix on the back side or accompanying page.
2. This erratum is issued by the California Building Standards Commission in order to correct nonsubstantive printing errors or omissions in California Code of Regulations, Title 24, Part 6, of the 2019 *California Energy Code*. Instructions are provided below.
3. Health and Safety Code Section 18938.5 establishes that only building standards in effect at the time of the application for a building permit may be applied to the project plans and construction. This rule applies to both adoptions of building standards for Title 24 by the California Building Standards Commission, and local adoptions and ordinances imposing building standards. An erratum to Title 24 is a nonregulatory correction because of a printing error or omission that does not differ substantively from the official adoption by the California Building Standards Commission. Accordingly, the corrected code text provided by this erratum may be applied on and after the stated effective date.
4. You may wish to retain the superseded material with this revision record so that the prior wording of any section can be easily ascertained.

#### Title 24, Part 6

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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]

**(d) Operation and control requirements for minimum quantities of outdoor air.**

1. **Times of occupancy.** The minimum rate of outdoor air required by Section 120.1(c) shall be supplied to each space at all times when the space is usually occupied.

**Exception 1 to Section 120.1(d)1:** Demand control ventilation. In intermittently occupied spaces that do not have processes or operations that generate dusts, fumes, mists, vapors or gasses and are not provided with local exhaust ventilation (such as indoor operation of internal combustion engines or areas designated for unvented food service preparation), the rate of outdoor air may be reduced if the ventilation system serving the space is controlled by a demand control ventilation device complying with Section 120.1(d)4 or by an occupant sensor ventilation control device complying with Section 120.1(d)5.

**Exception 2 to Section 120.1(d)1:** Temporary reduction. The rate of outdoor air provided to a space may be reduced below the level required by Section 120.1(c)2 for up to 30 minutes at a time if the average rate for each hour is equal to or greater than the required ventilation rate.

2. **Pre-occupancy.** The lesser of the minimum rate of outdoor air required by Section 120.1(c)2 or three complete air changes shall be supplied to the entire building during the one-hour period immediately before the building is normally occupied.
3. **Required demand control ventilation.** Demand ventilation controls complying with 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 1,000 square feet (40 square feet or less per person) if the system serving the space has one or more of the following:

A. an air economizer; or

B. modulating outside air control; or

C. design outdoor airflow rate > 3,000 cfm

**Exception 1 to Section 120.1(d)3:** Where space exhaust is greater than the design ventilation rate specified in Section 120.1(c)3 minus 0.2 cfm per square foot of conditioned area.

**Exception 2 to Section 120.1(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 sick-rooms, science labs, barber shops or beauty and nail salons shall not install demand control ventilation.

**Exception 3 to Section 120.1(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(c)3.

**4. Demand control ventilation devices.**

- A. For each system with demand control ventilation (DCV), CO<sub>2</sub> sensors shall be installed in each room that meets the criteria of Section 120.1(d)3 with no less than one sensor per 10,000 square feet of floor space. When a zone or a space is served by more than one sensor, a signal from any sensor indicating that CO<sub>2</sub> is near or at the setpoint within the zone or space, shall trigger an increase in ventilation.
- B. CO<sub>2</sub> sensors shall be located in the room between 3 feet and 6 feet above the floor or at the anticipated height of the occupants' heads.
- C. Demand ventilation controls shall maintain CO<sub>2</sub> concentrations less than or equal to 600 ppm plus the outdoor air CO<sub>2</sub> concentration in all rooms with CO<sub>2</sub> sensors.

**Exception to Section 120.1(d)4C:** The outdoor air ventilation rate is not required to be larger than the design outdoor air ventilation rate required by Section 120.1(c)3 regardless of CO<sub>2</sub> concentration.

- D. Outdoor air CO<sub>2</sub> concentration shall be determined by one of the following:
  - i. CO<sub>2</sub> concentration shall be assumed to be 400 ppm without any direct measurement; or
  - ii. CO<sub>2</sub> concentration shall be dynamically measured using a CO<sub>2</sub> sensor located within 4 feet of the outdoor air intake.
- E. When the system is operating during hours of expected occupancy, the controls shall maintain system outdoor air ventilation rates no less than the rate listed in Table 120.1-A for DCV, times the conditioned floor area for spaces with CO<sub>2</sub> sensors, plus the rate required by Section 120.1(c)3 for other spaces served by the system, or the exhaust air rate, whichever is greater.
- F. CO<sub>2</sub> sensors shall be certified by the manufacturer to be accurate within plus or minus 75 ppm at a 600 and 1000 ppm concentration when measured at sea level and 25°C, factory calibrated and certified by the manufacturer to require calibration no more frequently than once every 5 years. Upon detection of sensor failure, the system shall provide a signal which resets to supply the minimum quantity of outside air to levels required by Section 120.1(c)3 to the zone serviced by the sensor at all times that the zone is occupied.
- G. The CO<sub>2</sub> sensor(s) reading for each zone shall be displayed continuously, and shall be recorded on systems with DDC to the zone level.

5. **Occupant sensor ventilation control devices.** When occupancy sensor ventilation devices are required by Section 120.2(e)3, occupant sensors shall be used to reduce the rate of outdoor air flow when occupants are not present in accordance with the following:

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

(e) **Ducting for zonal heating and cooling units.** Where a return plenum is used to distribute outdoor air to a zonal heating or cooling unit, which then supplies the air to a space in order to meet the requirements of Section 120.1(c)3, the outdoor air shall be ducted to discharge either:

- 1. Within 5 feet of the unit; or
- 2. Within 15 feet of the unit, substantially toward the unit, and at a velocity not less than 500 feet per minute.

(f) **Design and control requirements for quantities of outdoor air.**

- 1. All mechanical ventilation and space-conditioning systems shall be designed with and have installed ductwork, dampers and controls to allow outside air rates to be operated at the larger of (1) the minimum levels specified in Section 120.1(c)3; or (2) the rate required for make-up of exhaust systems that are required for an exempt or covered process, for control of odors, or for the removal of contaminants within the space.
- 2. All variable air volume mechanical ventilation and space-conditioning systems shall include dynamic controls that maintain measured outside air ventilation rates within 10 percent of the required outside air ventilation rate at both full and reduced supply airflow conditions. Fixed minimum damper position is not considered to be dynamic and is not an allowed control strategy.
- 3. Measured outdoor air rates of constant volume mechanical ventilation and space-conditioning systems shall be within 10 percent of the required outside air rate.

(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)2A through 120.1(g)2E:
  - 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 percent of the outdoor air intake flow.

- 3. Class 3 air. Recirculation or transfer of Class 3 air shall be permitted in accordance with Section 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 percent 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 from 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]

## SECTION 120.5 REQUIRED NONRESIDENTIAL MECHANICAL SYSTEM ACCEPTANCE

Nonresidential, high-rise residential, and hotel/motel buildings shall comply with the applicable requirements of Sections 120.5(a) through 120.5(b).

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

(a) Before an occupancy permit is granted, the following equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements:

1. Outdoor air ventilation systems shall be tested in accordance with NA7.5.1.
2. Constant volume, single zone unitary air conditioning and heat pump unit controls shall be tested in accordance with NA7.5.2.
3. Duct systems shall be tested in accordance with NA7.5.3 where either:
  - A. They are new duct systems that meet the criteria of Sections 140.4(l)1a, 140.4(l)1b and 140.4(l)1c, or
  - B. They are part of a system that meets the criteria of Section 141.0(b)2D.

4. Air economizers shall be tested in accordance with NA7.5.4.

**Exception to Section 120.5(a)4:** Air economizers installed by the HVAC system manufacturer and certified to the Commission as being factory calibrated and tested are exempt from the Functional Testing section of the air economizer controls acceptance test as described in NA7.5.4.2.

5. Demand control ventilation systems required by Section 120.1(c)3 shall be tested in accordance with NA7.5.5.
6. Supply fan variable flow controls shall be tested in accordance with NA7.5.6.
7. Hydronic system variable flow controls shall be tested in accordance with NA7.5.7 and NA7.5.9.
8. Boiler or chillers that require isolation controls as specified by Section 140.4(k)2 or 140.4(k)3 shall be tested in accordance with NA7.5.7.
9. Hydronic systems with supply water temperature reset controls shall be tested in accordance with NA7.5.8.
10. Automatic demand shed controls shall be tested in accordance with NA7.5.10.
11. Fault Detection and Diagnostics (FDD) for Packaged Direct-Expansion Units shall be tested in accordance with NA7.5.11.

12. Automatic fault detection and diagnostics (FDD) for air handling units and zone terminal units shall be tested in accordance with NA7.5.12.
13. Distributed Energy Storage DX AC Systems shall be tested in accordance with NA7.5.13.
14. Thermal Energy Storage (TES) Systems shall be tested in accordance with NA7.5.14.
15. Supply air temperature reset controls shall be tested in accordance with NA7.5.15.
16. Water-cooled chillers served by cooling towers with condenser water reset controls shall be tested in accordance with NA7.5.16.
17. When an energy management control system is installed, it shall functionally meet all of the applicable requirements of Part 6.
18. Occupant sensing zone controls shall be tested in accordance with NA7.5.17.

(b) When certification is required by Title 24, Part 1, Section 10-103.2, the acceptance testing specified by Section 120.5(a) shall be performed by a certified mechanical acceptance test technician (CMATT). If the CMATT is operating as an employee, the CMATT shall be employed by a certified mechanical acceptance test employer. The CMATT shall disclose on the certificate of acceptance a valid CMATT certification identification number issued by an approved acceptance test technician certification provider. The CMATT shall complete all certificate of acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

**Note:** Authority cited: Sections 25402, 25402.1 and 25213 *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8 and 25943 *Public Resources Code*.

## SECTION 120.6 MANDATORY REQUIREMENTS FOR COVERED PROCESSES

Nonresidential, high-rise residential, and hotel/motel buildings shall comply with the applicable requirements of Sections 120.6(a) through 120.6(g).

(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 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).

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

**TABLE 120.6-A REFRIGERATED WAREHOUSE INSULATION**

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

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

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

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

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

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

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

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

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

**Exception 3 to Section 120.6(a)3B:** Areas within refrigerated warehouses that are designed solely for the purpose of quick chilling/freezing of products, including but not limited to spaces with design cooling capacities of greater than 240 Btu/hr-ft<sup>2</sup> (2 tons per 100 square feet).

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

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

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 where 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. The design drybulb temperature plus 10°F for systems serving freezers;
- ii. 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;

8. Hotel motel guest rooms shall have captive card key controls, occupancy sensing controls, or automatic controls such that, no longer than 20 minutes after the guest room has been vacated, lighting power is switched off.

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

**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.

(d) **Automatic daylighting controls.** The general lighting in skylit daylight zones and primary sidelit daylight zones, as well as the general lighting in the combined primary and secondary sidelit daylight 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 daylight zone definition shall apply to the floor area directly under the atrium and the top floor area directly adjacent to the atrium.

1. All skylit daylight zones and primary sidelit daylight zones, and the combined primary and secondary sidelit daylight 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 daylight areas.

2. The automatic daylighting controls shall provide separate control for luminaires in each type of daylight zone. Luminaires that fall in both a skylit and sidelit daylight zone shall be controlled as part of the skylit daylight zone.
3. The automatic daylighting controls shall:
  - A. For spaces required to install multilevel controls under Section 130.1(b), adjust lighting via continuous dimming or the number of control steps provided by the multilevel controls;
  - B. For each space, ensure the combined illuminance from the controlled lighting and daylight is not less than the illuminance from controlled lighting when no daylight is available;
  - C. 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 daylight 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 daylight zones in retail merchandise sales and wholesale showroom areas.

(e) **Demand responsive controls.** See Section 110.12 for requirements for demand responsive lighting controls.

(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 daylight 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.

**Note:** Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

## **SECTION 130.2 OUTDOOR LIGHTING CONTROLS AND EQUIPMENT**

Nonresidential, high-rise residential and hotel/motel buildings shall comply with the applicable requirements of Sections 130.2(a) through 130.2(c).

(a) **Reserved.**

(b) **Luminaire cutoff requirements.** All outdoor luminaires of 6,200 initial luminaire lumens or greater, 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 5.106.8.

**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.

**TABLE 130.1-A  
MULTILEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS**

<b>LUMINAIRE TYPE</b>	<b>MINIMUM REQUIRED CONTROL STEPS (percent of full rated power<sup>1</sup>)</b>				<b>UNIFORM LEVEL OF ILLUMINANCE SHALL BE ACHIEVED BY:</b>
Line-voltage sockets except GU-24	Continuous dimming 10-100 percent				
Low-voltage incandescent systems					
LED luminaires and LED source systems					
GU-24 rated for LED					
GU-24 sockets rated for fluorescent > 20 watts	Continuous dimming 20-100 percent				
Pin-based compact fluorescent > 20 watts <sup>2</sup>					
GU-24 sockets rated for fluorescent ≤ 20 watts	Minimum one step between 30-70 percent				Stepped dimming; or Continuous dimming; or Switching alternate lamps in a luminaire
Pin-based compact fluorescent ≤ 20 watts <sup>2</sup>					
Linear fluorescent and U-bent fluorescent ≤ 13 watts					
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range:				Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of four lamps per luminaire, illuminating the same area and in the same manner
	20-40%	50-70%	75-85%	100%	
Track Lighting	Minimum one step between 30 – 70 percent				Step dimming; or Continuous dimming; or Separately switching circuits in multicircuit track with a minimum of two circuits.
HID > 20 watts	Minimum one step between 50 - 70 percent				Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of two lamps per luminaire, illuminating the same area and in the same manner.
Induction > 25 watts					
Other light sources					

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.



**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.

(c) **Controls for outdoor lighting.** Outdoor lighting shall be independently controlled from other electrical loads, and the controls for outdoor lighting shall meet the following functional requirements:

**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, 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.

**Exception 1 to Section 130.2(c)3:** Luminaires with a maximum rated wattage of 40 watts each are not required to have motion sensing controls.

**Exception 2 to Section 130.2(c)3:** Applications listed as Exceptions to Section 140.7(a) 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.

**Note:** Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

### SECTION 130.3 SIGN LIGHTING CONTROLS

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.

**Note:** Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

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

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.

(a) **Lighting control acceptance requirements.** Before an occupancy permit is granted, indoor and outdoor lighting controls serving the building, area or site shall be certified as meeting the Acceptance Requirements for Code Compliance in accordance with Section 130.4(a). A Certificate of Acceptance shall be submitted to the enforcement agency under Section 10-103(a) of Part 1, that:

1. Certifies that all of the lighting acceptance testing necessary to meet the requirements of Part 6 is completed;
2. Certifies that the applicable procedures in Reference Nonresidential Appendix NA7.6 and NA7.8 have been followed;
3. Certifies that automatic daylight controls comply with Section 130.1(d) and Reference Nonresidential Appendix NA7.6.1;
4. Certifies that lighting shut-OFF controls comply with Section 130.1(c) and Reference Nonresidential Appendix NA7.6.2;
5. Certifies that demand responsive controls comply with Section 130.1(e) and Reference Nonresidential Appendix NA7.6.3; and
6. Certifies that outdoor lighting controls comply with the applicable requirements of Section 130.2(c) and Reference Nonresidential Appendix NA7.8; and
7. Certifies that lighting systems receiving the Institutional Tuning Power Adjustment Factor comply with Section 140.6(a)2J and Reference Nonresidential Appendix NA7.7.5.2.

(b) **Lighting control installation certificate requirements.** To be recognized for compliance with Part 6 an installation certificate shall be submitted in accordance with Section 10-103(a) for any lighting control system, energy management control system, track lighting integral current limiter, track lighting supplementary overcurrent protection panel, interlocked lighting system, lighting power adjustment factor, or additional wattage available for a videoconference studio, in accordance with the following requirements, as applicable:

1. Certification that when a lighting control system is installed to comply with lighting control requirements in Part 6 it complies with the applicable requirements of Section 110.9; and complies with Reference Nonresidential Appendix NA7.7.1.
2. Certification that when an energy management control system is installed to function as a lighting control required by Part 6 it functionally meets all applicable requirements for each application for which it is installed, in accordance with Sections 110.9, 130.0 through 130.5, 140.6 through 150.0, and 150.2; and complies with Reference Nonresidential Appendix NA7.7.2.
3. **Reserved.**
4. **Reserved.**
5. Certification that interlocked lighting systems used to serve an approved area comply with Section 140.6(a)1; and comply with Reference Nonresidential Appendix NA7.7.4.

6. Certification that lighting controls installed to earn a lighting power adjustment factor (PAF) comply with Section 140.6(a)2; and comply with Reference Nonresidential Appendix NA7.7.5.

7. Certification that additional lighting wattage installed for a videoconference studio complies with Section 140.6(c)2Gvii; and complies with Reference Nonresidential Appendix NA7.7.6.

(c) When certification is required by Title 24, Part 1, Section 10-103.1, the acceptance testing specified by Section 130.4 shall be performed by a certified lighting controls acceptance test technician (CLCATT). If the CLCATT is operating as an employee, the CLCATT shall be employed by a certified lighting controls acceptance test employer. The CLCATT shall disclose on the Certificate of Acceptance a valid CLCATT certification identification number issued by an approved acceptance test technician certification provider. The CLCATT shall complete all certificate of acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

**Note:** Authority cited: Sections 25402, 25402.1 and 25213 *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943 *Public Resources Code*.

## SECTION 130.5 ELECTRICAL POWER DISTRIBUTION SYSTEMS

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.

(c) **Voltage drop.** The maximum combined voltage drop on both installed feeder conductors and branch circuit conductors to the farthest connected load or outlet shall not exceed 5 percent.

**Exception to Section 130.5(c):** Voltage drop permitted by *California Electrical Code* Sections 647.4, 695.6 and 695.7.

(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:

1. Install a control capable of automatically shutting OFF the controlled receptacles when the space is typically unoccupied, either at the receptacle or circuit level. When an automatic time switch control is installed it shall incorporate an override control that allows the controlled receptacle to remain ON for no more than 2 hours when an override is initiated and an automatic holiday "shut-OFF" feature that turns OFF all loads for at least 24 hours and then resumes the normally scheduled operation. Countdown timer switches shall not be used to comply with the automatic time switch control requirements; and
2. Install at least one controlled receptacle within 6 feet from each uncontrolled receptacle or install a splitwired receptacle with at least one controlled and one uncontrolled receptacle. Where receptacles are installed in modular furniture in open office areas, at least one controlled receptacle shall be installed at each workstation; and
3. Provide a permanent and durable marking for controlled receptacles or to differentiate them from uncontrolled receptacles or circuits; and
4. For hotel and motel guest rooms, install controlled receptacles for at least one-half of the 120-volt receptacles in each guestroom. Electric circuits serving controlled receptacles in guestrooms shall have captive card key controls, occupancy sensing controls, or automatic controls so the power is switched OFF no longer than 30 minutes after the guestroom has been vacated.

**NOTE:** A hardwired power strip controlled by an occupant sensing control may be used to comply with Section 130.5(d). Plug-in strips and other plug-in devices shall not be used to comply with the requirements of this section.

**Exception 1 to Section 130.5(d):** Receptacles that are only for the following purposes:

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

**NONRESIDENTIAL, HIGH-RISE RESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES—MANDATORY REQUIREMENTS FOR LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS**

- v. Receptacles connected to an uninterruptible power supply (UPS) that are intended to be in continuous use, 24 hours per day/365 days per year, and are marked to differentiate them from other uncontrolled receptacles or circuits.

**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.

**NOTE:** Definitions of terms and phrases in Section 130.5 are determined as specified in Section 100.1(b). Terms and phrases not found in Section 100.1(b) shall be defined as specified in Title 24, Part 3, Article 100 of the *California Electrical Code*.

**Note:** Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

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

METERING FUNCTIONALITY	ELECTRICAL SERVICES RATED 50 kVA OR LESS	ELECTRICAL SERVICES RATED MORE THAN 50 kVA AND LESS THAN OR EQUAL TO 250 kVA	ELECTRICAL SERVICES RATED MORE THAN 250 kVA AND LESS THAN OR EQUAL TO 1000kVA	ELECTRICAL SERVICES RATED MORE THAN 1000kVA
Instantaneous (at the time) kW demand	Required	Required	Required	Required
Historical peak demand (kW)	Not required	Not required	Required	Required
Tracking kWh for a user-definable period.	Required	Required	Required	Required
kWh per rate period	Not required	Not required	Not required	Required

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

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

C. The entire building has an air leakage rate not exceeding 0.40 cfm/ft<sup>2</sup> at a pressure differential of 0.3 in of water (1.57 psf) (2.0 L/ m<sup>2</sup> at 75 pa), when the entire building is tested, after completion of construction, in accordance with ASTM E779 or another test method approved by the Commission.

**Exception to Section 140.3(a)9:** Relocatable public school buildings.

(b) **Reserved.**

(c) **Minimum daylighting requirement for large enclosed spaces.** In climate zones 2 through 15, conditioned enclosed spaces, and unconditioned enclosed spaces that are greater than 5,000 square feet and that are directly under a roof with ceiling heights greater than 15 feet, shall meet the following requirements:

1. A combined total of at least 75 percent of the floor area, as determined in building floor plan (drawings) view, shall be within one or more of the following:
  - A. Primary sidelit daylit zone in accordance with Section 130.1(d), or
  - B. The total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights.
2. All skylit daylit zones and primary sidelit daylit zones shall be shown on building plans.
3. General lighting in daylit zones shall be controlled in accordance with Section 130.1(d).
4. The total skylight area is at least 3 percent of the total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights; or the product of the total skylight area and the average skylight visible transmittance is no less than 1.5 percent of the total floor area in

the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights.

5. All skylights shall have a glazing material or diffuser that has a measured haze value greater than 90 percent, tested according to ASTM D1003 (notwithstanding its scope) or other test method approved by the Commission.

6. Skylights for conditioned and unconditioned spaces shall have an area-weighted average visible transmittance (VT) no less than the applicable value required by Section 140.3(a)6D.

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

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

- A. A floor area of less than or equal to 5,000 square feet, or
- B. Ceiling heights of less than or equal to 15 feet.

This exception shall not be used for S-1 or S-2 (storage), or for F-1 or F-2 (factory) occupancies.

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

**Exception 4 to Section 140.3(c):** Enclosed spaces where it is documented that permanent architectural features of the building, existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed space for more than 1500 daytime hours per year between 8 a.m. and 4 p.m.

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

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

**NONRESIDENTIAL, HIGH-RISE RESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES—  
COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY**

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

				CLIMATE ZONE																
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
ENVELOPE	Maximum U-factor	Roofs/ Ceilings	Metal building	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	
			Wood-framed and other	0.034	0.034	0.034	0.034	0.034	0.049	0.049	0.049	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	
		Walls	Metal building	0.113	0.061	0.113	0.061	0.061	0.113	0.113	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.061
			Metal-framed	0.069	0.062	0.082	0.062	0.062	0.069	0.069	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
			Mass light <sup>1</sup>	0.196	0.170	0.278	0.227	0.440	0.440	0.440	0.440	0.440	0.170	0.170	0.170	0.170	0.170	0.170	0.170	
			Mass heavy <sup>1</sup>	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.160	
			Wood-framed and other	0.095	0.059	0.110	0.059	0.102	0.110	0.110	0.102	0.059	0.059	0.045	0.059	0.059	0.059	0.042	0.059	
		Floors/ Soffits	Raised mass	0.092	0.092	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.092	0.092	0.092	0.092	0.092	0.058	
			Other	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039	
	Roofing Products	Low-sloped	Aged solar reflectance	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	
			Thermal emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
		Steep-sloped	Aged solar reflectance	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
			Thermal emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
	Air Barrier			NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	
	Exterior Doors, Maximum U-factor		Nonswinging	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50	
			Swinging	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	

ENVELOPE	FENESTRATION			ALL CLIMATE ZONES				
					Fixed Window	Operable Window	Curtainwall or Storefront	Glazed <sup>2</sup> Doors
		Vertical	Area-Weighted performance rating	Max U-factor	0.36	0.46	0.41	0.45
				Max RSHGC	0.25	0.22	0.26	0.23
			Area-Weighted performance rating	Min VT	0.42	0.32	0.46	0.17
			Maximum WWR%	40%				
		Skylights			Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted	Tubular Daylighting Devices (TDDs)
			Area-Weighted performance rating	Max U-factor	0.58	0.46	0.88	0.88
				Max SHGC	0.25	0.25	NR	NR
			Area-Weighted performance rating	Min VT (Min VT <sub>annual</sub> for TDDs)	0.49	0.49	0.64	0.64
			Maximum SRR%	5%				

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

**NONRESIDENTIAL, HIGH-RISE RESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES—  
COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY**

**TABLE 140.3-C  
PRESCRIPTIVE ENVELOPE CRITERIA FOR HIGH-RISE RESIDENTIAL BUILDINGS AND GUESTROOMS OF HOTEL/MOTEL BUILDINGS**

				CLIMATE ZONE															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ENVELOPE	Maximum U-factor	Roofs/ Ceilings	Metal building	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041
			Wood-framed and other	0.028	0.028	0.034	0.028	0.034	0.034	0.039	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
		Walls	Metal building	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.057	0.057	0.057	0.057	0.057
			Metal-framed	0.069	0.069	0.069	0.069	0.069	0.069	0.105	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.048	0.069
			Mass light <sup>1</sup>	0.170	0.170	0.170	0.170	0.170	0.227	0.227	0.227	0.196	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass heavy <sup>1</sup>	0.160	0.160	0.160	0.184	0.211	0.690	0.690	0.690	0.690	0.690	0.184	0.253	0.211	0.184	0.184	0.160
			Wood-framed and other	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.042	0.059	0.059	0.042	0.042	0.042
		Floors/ Soffits	Raised mass	0.045	0.045	0.058	0.058	0.058	0.069	0.092	0.092	0.092	0.669	0.058	0.058	0.058	0.045	0.058	0.037
			Other	0.034	0.034	0.039	0.039	0.039	0.039	0.071	0.039	0.039	0.039	0.039	0.039	0.039	0.034	0.039	0.034
	Roofing Products	Low- sloped	Aged solar reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.55	0.55	0.55	NR	0.55	0.55	NR
			Thermal emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	NR
		Steep- sloped	Aged solar reflectance	NR	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	NR
			Thermal emittance	NR	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	NR
	Exterior Doors, Maximum U-factor	Nonswinging		0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50
		Swinging		0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

ENVELOPE	FENESTRATION	ALL CLIMATE ZONES					
				Fixed Window	Operable Window	Curtainwall or Storefront	Glazed <sup>2</sup> Doors
		Vertical	Area-Weighted performance rating	Max U-factor	0.36	0.46	0.41
				Max RSHGC	0.25	0.22	0.26
			Area-Weighted performance rating	Min VT	0.42	0.32	0.46
			Maximum WWR%	40%			
		Skylights	Area-Weighted performance rating	Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted	
				Max U-factor	0.58	0.46	0.88
			Area-Weighted performance rating	Max SHGC	0.25	0.25	NR
			Area-Weighted performance rating	Min VT	0.49	0.49	0.64
			Maximum SRR%	5%			

- As defined in Section 100.1, light mass walls are walls with a heat capacity of at least 7.0 Btu/h-ft<sup>2</sup> and less than 15.0 Btu/h-ft<sup>2</sup>. Heavy mass walls are walls with a heat capacity of at least 15.0 Btu/h-ft<sup>2</sup>.
- Glazed doors applies to both site-built and to factory-assembled glazed doors.

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

Roofs/ Ceilings	Metal Buildings	Maximum <i>U</i> -factor		0.041	
	Non-Metal Buildings			0.034	
Walls	Wood frame buildings			0.042	
	Metal frame buildings			0.057	
	Metal Buildings			0.057	
	Mass/7.0 ≤ HC			0.170	
	All Other Walls			0.059	
Floors and Soffits	Floors and Soffits			0.048	
Roofing Products	Low-Sloped	Aged Solar Reflectance		0.63	
		Thermal Emittance		0.75	
	Steep-Sloped	Aged Solar Reflectance		0.20	
		Thermal Emittance		0.75	
Fenestration	Windows	Maximum <i>U</i> -factor		0.47	
		Maximum SHGC		0.26	
	Glazed Doors (Site-Built and Factory Assembled)	Maximum <i>U</i> -factor		0.45	
		Maximum SHGC		0.23	
	Skylights	Glass with Curb		Maximum <i>U</i> -factor	0.99
		Glass without Curb			0.57
		Plastic with Curb			0.87
		Glass Type	0-2% SRR	Maximum SHGC	0.46
			2.1-5% SRR		0.36
		Plastic Type	0-2% SRR		0.69
			2.1-5% SRR		0.57
Exterior Doors		Non-Swinging doors	Maximum <i>U</i> -factor		0.50
	Swinging doors	0.70			

(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.

**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
Exterior Light Shelf	South	0.25 to 1.25

**EQUATION 140.3-E  
PROJECTION AND DISTANCE FACTOR CALCULATION**

Projection Factor = Projection/Spacing

Distance Factor =  $D/(H_{AS} \times \text{Projection Factor})$

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.

**Note:** Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 140.4  
PRESCRIPTIVE REQUIREMENTS  
FOR SPACE-CONDITIONING SYSTEMS**

A building complies with this section by being designed with and having constructed and installed a space-conditioning system that meets the applicable requirements of Subsections (a) through (o).

(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).

**Exception 1 to Section 140.4(a):** Where it can be demonstrated to the satisfaction of the enforcing agency that oversizing will not increase building TDV energy use.

**Exception 2 to Section 140.4(a):** Standby equipment with controls that allow the standby equipment to operate only when the primary equipment is not operating.

**Exception 3 to Section 140.4(a):** Multiple units of the same equipment type, such as multiple chillers and boilers, having combined capacities exceeding the design load, if they have controls that sequence or otherwise optimally control the operation of each unit based on load.

(b) **Calculations.** In making equipment sizing calculations under Subsection (a), all of the following rules shall apply:

1. **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 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.
2. **Indoor design conditions.** Indoor design temperature and humidity conditions for 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, except that winter humidification and summer dehumidification shall not be required.
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)3:** Cooling design temperatures for cooling towers shall be no greater than the 0.5 percent cooling design wet bulb values.

4. **Ventilation.** Outdoor air ventilation loads shall be calculated using the ventilation rates required in Section 120.1(c)3.

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. **Lighting.** Lighting heating and cooling loads shall be based on actual design lighting levels or power densities as specified in Section 140.6.
7. **People.** Occupant density shall be based on the expected occupancy of the building and shall be the same as determined under Section 120.1(c)3A, if used. Sensible and latent heat gains shall be as listed in the 2005 ASHRAE Handbook- Fundamentals, Chapter 30, Table 1.
8. **Process loads.** Loads caused by a process shall be based upon actual information on the intended use of the building.
9. **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. **Internal heat gains.** Internal heat gains may be ignored for heating load calculations.
11. **Safety factor.** Calculated design 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. **Other loads.** Loads such as warm-up or cool-down shall be calculated from principles based on the 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.

(c) **Fan 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 and 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.

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.

of two 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 air flow 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-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

(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.

(o) **Exhaust system transfer air.** Conditioned supply air delivered to any space with mechanical exhaust shall not exceed the greater of:

1. The supply flow required to meet the space heating or cooling load; or
2. The ventilation rate required by the authority having jurisdiction, the facility Environmental Health and Safety Department, or by Section 120.1(c)3; or
3. The mechanical exhaust flow minus the available transfer air. Available transfer air shall be from another conditioned space or return air plenums on the same floor

and same smoke or fire compartment, and that at their closest point are within 15 feet of each other.

**Exception 1 to Section 140.4(o):** Biosafety level classified laboratories 3 or higher.

**Exception 2 to Section 140.4(o):** Vivarium spaces.

**Exception 3 to Section 140.4(o):** Spaces that are required by applicable codes and standards to be maintained at a positive pressure differential relative to adjacent spaces.

**Exception 4 to Section 140.4(o):** Spaces where the highest amount of transfer air that could be used for exhaust makeup may exceed the available transfer airflow rate and where the spaces have a required negative pressure relationship.

**Exception 5 to Section 140.4(o):** Healthcare facilities.

**Note:** Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

## SECTION 140.5 PRESCRIPTIVE REQUIREMENTS FOR SERVICE WATER-HEATING SYSTEMS

(a) **Nonresidential occupancies.** A service water-heating system installed in a nonresidential building complies with this section if it complies with the applicable requirements of Sections 110.1, 110.3 and 120.3.

(b) **High-rise residential and hotel/motel occupancies.** A service water-heating system installed in high-rise residential or hotel/motel buildings complies with this section if it meets the requirements of Section 150.1(c)8.

**Note:** Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

## SECTION 140.6 PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING

A building complies with this section if:

- i. The calculation of 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 daylight zone requirements in Subsection (d).

The prescriptive limits on indoor lighting power are the smaller of the adjusted and allowed indoor lighting power values determined in accordance with Item i.

(a) **Calculation of adjusted indoor lighting power.** The 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 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 adjusted indoor lighting power density if:
  - A. An installation certificate detailing compliance with Section 140.6(a)1 is submitted in accordance with Sections 10-103 and 130.4; and
  - B. The area or areas served by the interlocking systems is an auditorium, a convention center, a conference room, a multipurpose room or a theater; and
  - C. The two lighting systems are interlocked with a nonprogrammable double-throw switch to prevent simultaneous operation of both systems.

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.

2. **Reduction of wattage through controls.** In calculating adjusted 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:
  - A. An installation certificate is submitted in accordance with Section 130.4(b), and
  - B. Luminaires and controls meet the applicable requirements of Section 110.9, and Sections 130.0 through 130.5; and
  - C. The controlled lighting is permanently installed general lighting systems and the controls are permanently installed nonresidential-rated lighting controls.

When used for determining PAFs for general lighting in offices, furniture mounted luminaires that comply with all of the following conditions shall qualify as permanently installed general lighting systems:

- i. The furniture mounted luminaires shall be permanently installed no later than the time of building permit inspection; and
  - ii. The furniture mounted luminaires shall be permanently hardwired; and
  - iii. The furniture mounted lighting system shall be designed to provide indirect general lighting; and
  - iv. Before multiplying the installed watts of the furniture mounted luminaire by the applicable PAF, 0.3 watts per square foot of the area illuminated by the furniture mounted luminaires shall be subtracted from installed watts of the furniture mounted luminaires; and
  - v. The lighting control for the furniture mounted luminaire complies with all other applicable requirements in Section 140.6(a)2.
- D. At least 50 percent of the light output of the controlled luminaire is within the applicable area listed in Table 140.6-A. Luminaires on lighting tracks shall be within the applicable area in order to qualify for a PAF.
  - E. Only one PAF from Table 140.6-A may be used for each qualifying luminaire. PAFs shall not be added together unless allowed in Table 140.6-A.
  - F. Only lighting wattage directly controlled in accordance with Section 140.6(a)2 shall be used to reduce the installed watts as allowed by Section 140.6(a)2 for calculating the Adjusted Indoor Lighting Power. If only a portion of the wattage in a luminaire is controlled in accordance with Section 140.6(a)2, then only that portion of controlled wattage may be reduced in calculating adjusted indoor lighting power.
  - G. Lighting controls used to qualify for a PAF shall be designed and installed in addition to manual, multilevel, and automatic lighting controls required in Section 130.1, and in addition to any other lighting controls required by any provision of Part 6. PAFs shall not be available for lighting controls required by Part 6.
  - H. To qualify for the PAF for daylight dimming plus OFF control, the daylight control and controlled luminaires shall comply with Section 130.1(d), 130.4(a)3 and 130.4(a)7, and shall additionally turn lights completely OFF when the daylight available in the daylight zone is greater than 150 percent of the illuminance received from the gen-

**NONRESIDENTIAL, HIGH-RISE RESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES—  
COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY**

**TABLE 140.6-D  
TAILORED METHOD LIGHTING POWER ALLOWANCES**

1	2	3	4	5
Primary Function Area	General Illumination Level (Lux)	Wall Display Lighting Power Density (W/ft)	Allowed Combined Floor Display Power and Task Lighting Power Density (W/ft²)	Allowed Ornamental/Special Effect Lighting Power Density (W/ft²)
Auditorium area	300	3.00	0.20	0.40
Convention, conference, multipurpose, and meeting center areas	300	2.00	0.35	0.40
Dining areas	200	1.25	0.50	0.40
Exhibit, museum areas	150	11.50	0.80	0.40
Hotel area:				
Ballroom events	400	1.80	0.12	0.40
Lobby	200	3.50	0.20	0.40
Main entry lobby	200	3.50	0.20	0.40
Religious worship area	300	1.30	0.40	0.40
Retail sales				
Grocery	600	6.80	0.70	0.40
Merchandise sales, and showroom areas	500	11.80	0.80	0.40
Theater area:				0.5
Motion picture	200	2.00	0.20	0.40
Performance	200	7.50	0.20	0.40

**TABLE 140.6-E  
TAILORED WALL AND FLOOR DISPLAY MOUNTING HEIGHT ADJUSTMENT FACTORS**

HEIGHT IN FEET ABOVE FINISHED FLOOR AND BOTTOM OF LUMINAIRE(S)	FLOOR DISPLAY OR WALL DISPLAY – MOUNTING HEIGHT ADJUSTMENT FACTOR
≤ 10'-6"	1.00
> 10'-6" to 14'-0"	0.85
> 14'-0" to 18'-0"	0.75
> 18'-0"	0.70

**TABLE 140.6-F  
ROOM CAVITY RATIO (RCR) EQUATIONS**

Determine the room cavity ratio for Table 140.6-G using one of the following equations.
Room cavity ratio for rectangular rooms $RCR = \frac{5 \times H \times (L + W)}{L \times W}$
Room cavity ratio for irregular-shaped rooms $RCR = \frac{2.5 \times H \times P}{A}$
Where: <i>L</i> = Length of room; <i>W</i> = Width of room; <i>H</i> = Vertical distance from the work plane to the centerline of the lighting fixture; <i>P</i> = Perimeter of room; and <i>A</i> = Area of room

**TABLE 140.6-G**  
**TAILORED METHOD GENERAL LIGHTING POWER ALLOWED –BY ILLUMINANCE AND ROOM CAVITY RATIO**

GENERAL ILLUMINANCE LEVEL (LUX) <sup>a</sup>	GENERAL LIGHTING POWER DENSITY (W/FT <sup>2</sup> ) FOR THE FOLLOWING RCR VALUES <sup>b</sup> VALUES <sup>b</sup>			
	RCR ≤ 2.0	RCR > 2.0 AND ≤ 3.5	RCR > 3.5 AND ≤ 7.0	RCR > 7.0
150	0.40	0.45	0.60	0.75
200	0.45	0.55	0.75	1.00
300	0.65	0.80	1.00	1.40
400	0.75	0.95	1.25	1.50
500	0.90	1.05	1.45	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.

**Note:** Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

## SECTION 140.7 PRESCRIPTIVE REQUIREMENTS FOR OUTDOOR LIGHTING

(a) An outdoor lighting installation complies with this section if it meets the requirements in Subsections (b) and (c), and the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under Subsection (d). The allowed outdoor lighting shall be calculated according to outdoor lighting zone in Title 24, Part 1, Section 10-114.

**Exceptions to Section 140.7(a):** When more than 50 percent of the light from a luminaire falls within one or more of the following applications, the lighting power for that luminaire shall be exempt from Section 140.7:

1. Temporary outdoor lighting.
2. Lighting required and regulated by the Federal Aviation Administration, and the Coast Guard.
3. Lighting for public streets, roadways, highways and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way.
4. Lighting for sports and athletic fields, and children's playgrounds.
5. Lighting for industrial sites, including but not limited to, rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, and aviation facilities.
6. Lighting of public monuments.
7. Lighting of signs complying with the requirements of Sections 130.3 and 140.8.
8. Lighting of tunnels, bridges, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.

9. Landscape lighting.

10. In theme parks: outdoor lighting only for themes and special effects.

11. Lighting for outdoor theatrical and other outdoor live performances, provided that these lighting systems are additions to area lighting systems and are controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.

12. Outdoor lighting systems for qualified historic buildings, as defined in the *California Historic Building Code* (Title 24, Part 8), if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic buildings shall comply with Section 140.7.

**(b) Outdoor lighting power trade-offs.** Outdoor lighting power trade-offs shall be determined as follows:

1. Allowed lighting power determined according to Section 140.7(d)1 for general hardscape lighting allowance may be traded to specific applications in Section 140.7(d)2, provided the hardscape area from which the lighting power is traded continues to be illuminated in accordance with Section 140.7(d)1A.
2. Allowed lighting power determined according to Section 140.7(d)2 for additional lighting power allowances for specific applications shall not be traded between specific applications, or to hardscape lighting in Section 140.7(d)1.
3. Trading of lighting power allowances between outdoor and indoor areas shall not be permitted.

**(c) Calculation of actual lighting power.** The wattage of outdoor luminaires shall be determined in accordance with Section 130.0(c).

**(d) Calculation of allowed lighting power.** The allowed lighting power shall be the combined total of the sum of the

## SUBCHAPTER 7

# LOW-RISE RESIDENTIAL BUILDINGS— MANDATORY FEATURES AND DEVICES

### SECTION 150.0 MANDATORY FEATURES AND DEVICES

Low-rise residential buildings shall comply with the applicable requirements of Sections 150(a) through 150.0(r).

**NOTE:** The requirements of Sections 150.0(a) through 150.0(r) apply to newly constructed buildings. Sections 150.2(a) and 150.2(b) specify which requirements of Sections 150.0(a) through 150.0(r) also apply to additions or alterations.

(a) **Ceiling and rafter roof insulation.** The opaque portions of ceilings and roofs separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of Items 1 through 3 below:

1. Shall be insulated to achieve a weighted average *U*-factor not exceeding U-0.043 or shall be insulated between wood-framing members with insulation resulting in an installed thermal resistance of R-22 or greater for the insulation alone. For vented attics, the mandatory insulation shall be installed at the ceiling level; for unvented attics, the mandatory insulation shall be placed at either ceiling or roof level; and

**Exception to Section 150.0(a)1:** Ceilings and rafter roofs in an alteration shall be insulated to achieve a weighted average *U*-factor not exceeding 0.054 or shall be insulated between wood-framing members with insulation resulting in an installed thermal resistance of R-19 or greater.

2. Attic access doors shall have permanently attached insulation using adhesive or mechanical fasteners. The attic access shall be gasketed to prevent air leakage; and
3. Insulation shall be installed in direct contact with a continuous roof or ceiling which is sealed to limit infiltration and exfiltration as specified in Section 110.7, including but not limited to placing insulation either above or below the roof deck or on top of a drywall ceiling.

(b) **Loose-fill insulation.** When loose-fill insulation is installed, the minimum installed weight per square foot shall conform with the insulation manufacturer's installed design weight per square foot at the manufacturer's labeled *R*-value.

(c) **Wall insulation.** Opaque portions of above grade walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the following requirements:

1. 2 × 4 inch framing shall have an overall assembly *U*-factor not exceeding U-0.102.

**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-0.071.
3. Opaque nonframed assemblies shall have an overall assembly *U*-factor not exceeding U-0.102.
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 2x4 assemblies, and 20 in 2x6 assemblies.

(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. In a wood framed assembly, compliance with the *U*-factor may be demonstrated by installing insulation with an *R*-value of 19 or greater.

**Exception to Section 150.0(d):** A building with a controlled ventilation or unvented crawlspace may omit raised floor insulation if all of the following are met:

- i. The foundation walls are insulated to meet the wall insulation minimums as shown in Table 150.1-A or B; and
- ii. A Class I or Class II vapor retarder is placed over the entire floor of the crawl space; and
- iii. Vents between the crawlspace and outside air are fitted with automatically operated louvers that are temperature actuated; and
- iv. The requirements in Reference Residential Appendix RA4.5.1.

(e) **Installation of fireplaces, decorative gas appliances and gas logs.** 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:

1. Closable metal or glass doors covering the entire opening of the firebox; and
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)2:** 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.

3. A flue damper with a readily accessible control.

**Exception to Section 150.0(e)3:** 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.

(f) **Slab edge insulation.** Material used for slab edge insulation shall meet the following minimum specifications:

1. Water absorption rate for the insulation material alone without facings no greater than 0.3 percent when tested in accordance with Test Method A – 24-Hour-Immersion of ASTM C272.
2. Water vapor permeance no greater than 2.0 perm/inch when tested in accordance with ASTM E96.
3. Concrete slab perimeter insulation shall be protected from physical damage and ultraviolet light deterioration.
4. Insulation for a heated slab floor shall meet the requirements of Section 110.8(g).

(g) **Vapor retarder.**

1. In Climate Zones 1–16, the earth floor of unvented crawl space shall be covered with a Class I or Class II vapor retarder. This requirement shall also apply to controlled ventilation crawl space for buildings complying with the Exception to Section 150.0(d).
2. In Climate Zones 14 and 16, a Class I or Class II vapor retarder shall be installed on the conditioned space side of all insulation in all exterior walls, vented attics and unvented attics with air-permeable insulation.

(h) **Space-conditioning equipment.**

1. Building cooling and heating loads. Building heating and cooling loads shall be determined using a method based on any one of the following:
  - A. The ASHRAE Handbook, Equipment Volume, Applications Volume and Fundamentals Volume; or
  - B. The SMACNA Residential Comfort System Installation Standards Manual; or
  - C. The ACCA Manual J.

The cooling and heating loads are two of the criteria that shall be used for equipment sizing and selection.

**Note:** Heating systems are required to have a minimum heating capacity adequate to meet the minimum requirements of the CBC. The furnace output capacity and other specifications are published in the Commission's directory of certified equipment or other directories approved by the Commission.

2. **Design conditions.** For the purpose of sizing the space-conditioning (HVAC) system, the indoor design temperatures shall be 68°F for heating and 75°F for cooling. Outdoor design conditions shall be selected from Reference Joint Appendix JA2, which is based on data from the ASHRAE Climatic Data for Region X. The

outdoor design temperatures for heating shall be no lower than the Heating Winter Median of Extremes values. The outdoor design temperatures for cooling shall be no greater than the 1.0 percent Cooling Dry Bulb and Mean Coincident Wet Bulb values.

### 3. Outdoor condensing units.

**A. Clearances.** Installed air conditioner and heat pump outdoor condensing units shall have a clearance of at least five (5) feet (1.5 meters) from the outlet of any dryer vent.

**B. Liquid line drier.** Installed air conditioner and heat pump systems shall be equipped with liquid line filter driers if required, as specified by manufacturer's instructions.

### 4. Central forced-air heating furnaces.

**A. Temperature rise.** Central forced-air heating furnace installations shall be configured to operate in conformance with the furnace manufacturer's maximum inlet-to-outlet temperature rise specifications.

(i) **Thermostats.** All heating or cooling systems, including heat pumps, not controlled by a central energy management control system (EMCS) shall have a setback thermostat, as specified in Section 110.2(c).

(j) **Water system piping and insulation for piping, and tanks.**

1. **Storage tank insulation.** Unfired hot water tanks, such as storage tanks and backup storage tanks for solar water-heating systems, shall be externally wrapped with insulation having an installed thermal resistance of R-12 or greater or have internal insulation of at least R-16 and a label on the exterior of the tank showing the insulation R-value.

2. **Water piping, solar water-heating system piping, and space conditioning system line insulation thickness and conductivity.** Piping shall be insulated 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:

- i. The first 5 feet (1.5 meters) of cold water pipes from the storage tank.
- ii. All hot water piping with a nominal diameter equal to or greater than  $\frac{3}{4}$  inch (19 millimeter) and less than 1 inch.
- iii. All hot water piping with a nominal diameter less than  $\frac{3}{4}$  inch that is:
  - a. Associated with a domestic hot water recirculation system;
  - b. From the heating source to the kitchen fixtures;



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)4.

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)6.

(o) **Requirements for ventilation and indoor air quality.** 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 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 ventilation airflow 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 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.

$$Q_{tot} = 0.03A_{floor} + 7.5(N_{br} + 1) \quad \text{(Equation 150.0-B)}$$

where

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

$A_{floor}$  = dwelling-unit floor area, ft<sup>2</sup>

$N_{br}$  = 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.

$$Q_{50} = V_{du} \times 2 ACH_{50} / 60 \text{ min} \quad \text{(Equation 150.0-C)}$$

where

$Q_{50}$  = leakage rate at 50 Pa.

$V_{du}$  = dwelling unit conditioned volume, ft<sup>3</sup>.

$ACH_{50}$  = 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.

$$Q_{50} = V_{du} \times \text{Verified } ACH_{50} / 60 \text{ min} \quad \text{(Equation 150.0-D)}$$

where

$Q_{50}$  = leakage rate at 50 Pa.

$V_{du}$  = dwelling unit conditioned volume, ft<sup>3</sup>.

$ACH_{50}$  = 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].

$$Q_{inf} = 0.052 \times Q_{50} \times wsf \times [H/H_r]^z$$

**(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.

$$Q_{fan} = Q_{tot} - \Phi(Q_{inf} \times A_{ext})$$

**(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<sup>2</sup> 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.

- 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."

## SUBCHAPTER 8

# LOW-RISE RESIDENTIAL BUILDINGS—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

### SECTION 150.1 PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR LOW-RISE RESIDENTIAL BUILDINGS

(a) **Basic requirements.** Low-rise residential buildings shall meet all of the following:

1. The applicable requirements of Sections 110.0 through 110.10.
2. The applicable requirements of Section 150.0 (mandatory features).
3. Either the performance standards or the prescriptive standards set forth in this section for the climate zone in which the building is located. Climate zones are shown in Reference Joint Appendix JA2 –Weather/Climate Data.

**Exception to Section 150.1(a)3:** If a single contiguous subdivision or tract falls in more than one climate zone, all buildings in the subdivision or tract may be designed to meet the performance or prescriptive standards for the climate zone that contains 50 percent or more of the dwelling units.

**Note:** The Commission periodically updates, publishes, and makes available to interested persons and local enforcement agencies precise descriptions of the climate zones, as specified in Reference Joint Appendix JA2 –Weather/Climate Data.

**Note:** The requirements of Sections 150.0(a) through 150.0(r) apply to newly constructed buildings and Sections 150.2(a) and 150.2(b) specifies changes to the requirements of Sections 150.1(a) through 150.1(c) that apply to additions or alterations.

(b) **Performance standards.** A building complies with the performance standards if the energy consumption calculated for the proposed design building is no greater than the energy budget calculated for the standard design building 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.
3. **Compliance demonstration requirements for performance standards.**

**A. Certificate of compliance and application for a building permit.** The application for a building permit shall include documentation pursuant to Sections 10-103(a)1 and 10-103(a)2 which demonstrates, using an approved calculation method, that the building has been designed so that its Energy Efficiency Design Rating and the total EDR meets or exceeds the standard design EDR for the applicable climate zone.

**Exception to Section 150.1(b)3A Multiple orientation:** A permit applicant may demonstrate compliance with the energy budget requirements of Section 150.1(a) and (b) for any orientation of the same building model if the documentation demonstrates that the building model with its proposed designs and features would comply in each of the four cardinal orientations.

**B. Field verification.** When performance of installed features, materials, components, manufactured devices or systems 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.

- i. **SEER Rating.** When performance compliance requires installation of a space 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 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, 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 a Heating Seasonal Performance Factor (HSPF) rating that is greater than the minimum 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.

(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 Tables 150.1-A and 150.1-B, an NA (not allowed) means that feature is not permitted in a particular climate zone and an 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 150.1-A or B meeting Options ii or iii below.

i. Option A: **Reserved.**

ii. Option B: 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 multifamily 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.

#### B. Walls.

i. 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.

fications in 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.

- I. 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

- II. 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 requirements 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.

- 8. **Domestic water-heating-systems.** Water-heating-systems shall meet the requirements of A, B or C. For recirculation distribution systems serving individual dwelling unit, only demand recirculation systems with manual on/off control 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 requirements of i, ii, iii, iv, or v:

- i. One or more gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank.
- 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.
- b. A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.
- iii. A single gas or propane storage type water heater with an input of 75,000 Btu per hour or less, rated volume of more than 55 gallons.
- 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.
  - 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.
  - 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 heating system.
- ii. A recirculation system that meets the requirements of Sections 110.3(c)2 and 110.3(c)4, includes two or more separate recirculation loops serving separate dwelling units, and is capable of automatically controlling the recirculation pump operation based on measurement of hot water demand and hot water return temperature.

**Exception to Section 150.1(c)8Bii:** Buildings with eight or fewer dwelling units may use a single recirculation loop.

- iii. A solar water-heating system meeting the installation criteria specified in Reference Residential Appendix Section RA4 and with a minimum solar savings fraction of 0.20 in Climate Zones 1

through 9 or a minimum solar savings fraction of either a or b:

- 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.

9. **Space conditioning distribution systems.** All space conditioning systems shall meet all applicable requirements of A or B below:

A. High performance attics. Air handlers or ducts are allowed to be in ventilated attic spaces when the roof and ceiling insulation level meet Option B in Table 150.1-A or B. Duct insulation levels shall meet the requirements in Table 150.1-A or B.

B. Duct and air handlers located in conditioned space. Duct systems and air handlers of HVAC systems shall be located in conditioned space, and confirmed by field verification and diagnostic testing to meet the criterion of Reference Residential Appendix Section RA3.1.4.3.8. Duct insulation levels shall meet the requirements in Table 150.1-A or B.

**Note:** Gas heating appliances installed in conditioned spaces must meet the combustion air requirements of the *California Mechanical Code* Chapter 7, as applicable.

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.

11. **Roofing products.** All roofing products shall meet the requirements of Section 110.8 and the applicable requirements of Subsection A or B:

A. 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.

B. Low-rise residential buildings with low-sloped roofs, in climate zones 13 and 15 shall have a minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75 or a minimum SRI of 0.75.

**Exception 1 to Section 150.1(c)11:** Building integrated photovoltaic panels and building integrated solar thermal panels are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.

**Exception 2 to Section 150.1(c)11:** Roof constructions with a weight of at least 25 lb/ft<sup>2</sup> are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.

12. **Ventilation cooling.** Single-family homes shall comply with the whole-house fan (WHF) requirements shown in Table 150.1-A. When a WHF is required, comply with Subsections A through C below:

A. Have installed one or more WHFs whose total airflow CFM is equal to or greater than 1.5 CFM/ft<sup>2</sup> 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](http://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 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.

13. **HVAC system bypass ducts.** Bypass ducts that deliver conditioned supply air directly to the space conditioning system return duct airflow shall not be used.

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 Section RA3.3 or an approved alternative in Section 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 the procedures specified in Reference Residential Appendix Section RA3.3 or an approved alternative procedure as specified in Section RA1.
  1. 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
  2. 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 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 Section 110.12.

**Exception 2 to Section 150.2(b)1Fiia:** 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 Sections 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.
  1. 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

2. 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
3. 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 Sections RA3.2.2 and RA3.3 or approved alternatives in Section RA1.

**Exception to Section 150.2(b)1Fiib:** When the outdoor temperature is less than 55°F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1 to 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 Section 110.12. Ducted systems shall comply with the minimum system airflow rate requirements in Section 150.2(b)1Fiia.

- 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 Section RA3.2.3.2; and

- b. Systems that utilize forced air ducts shall comply with the minimum system airflow rate requirement in Section 150.2(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)1Fiib, 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.

- 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.

- H. **Water-heating system.** Altered or replacement 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 and iii 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 water heating system shall meet one of the following:
  - a. A natural gas or propane water-heating system; 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
- d. If no natural gas is connected to the existing water heater location, a consumer electric water heater; or
- e. A water-heating system determined by the executive director to use no more energy than the one specified in Item a above; or if no natural gas is connected to the 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 above.

- 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. 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 Section 150.2(b)1Ii:** 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 and 14, 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 to Section 150.2(b)1Iii:** Buildings with no ducts in the attic.

**Exception 2 to Section 150.2(b)1Iii:** The aged solar reflectance can be met by using insulation at the roof deck specified in Table 150.2-B.

- 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.
- 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.
  - A. The altered components shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (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.
  - B. The standard design for an altered component shall be the higher efficiency of existing conditions or the requirements stated in Table 150.2-C. For components not being altered, the standard design shall be based on the existing conditions. When the third party verification option is specified as a requirement, all components proposed for alteration for which the additional credit is taken, must be verified.

**TABLE 150.2-B  
AGED SOLAR REFLECTANCE INSULATION TRADE OFF TABLE**

AGED SOLAR REFLECTANCE	ROOF DECK INSULATION R-VALUE	AGED SOLAR REFLECTANCE	ROOF DECK INSULATION R-VALUE
0.62-0.60	2	0.44-0.40	12
0.59-0.55	4	0.39-0.35	16
0.54-0.50	6	0.34-0.30	20
0.49-0.45	8	0.29-0.25	24

C. The proposed design shall be based on the actual values of the altered components.

**Notes to Section 150.2(b)2:**

1. If an existing component must be replaced with a new component, that component is considered an altered component for the purpose of determining the standard design altered component energy budget and must meet the requirements of Section 152(b)2B.
2. The standard design shall assume the same geometry and orientation as the proposed design.
3. The “existing efficiency level” modeling rules, including situations where nameplate data are not available, are described in the Residential ACM Approval Manual.

**Exception 1 to Section 150.2(b):** Any dual- glazed greenhouse or/garden window installed as part of an alteration complies with the *U*-factor requirements in Section 150.1(c)3.

**Exception 2 to Section 150.2(b):** Where the space in the attic or rafter area is not large enough to accommodate the required *R*-value, the entire space shall be filled with insulation, provided such installation does not violate Section 1203.2 of Title 24, Part 2.

(c) **Whole building.** Any addition or alteration may comply with the requirements of Title 24, Part 6 by meeting the requirements for the entire building.

**Note:** Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, Public Resources Code. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, 25910, and 25943, Public Resources Code.

**TABLE 150.2-C  
STANDARD DESIGN FOR AN ALTERED COMPONENT**

<b>ALTERED COMPONENT</b>	<b>STANDARD DESIGN WITHOUT THIRD PARTY VERIFICATION OF EXISTING CONDITIONS SHALL BE BASED ON</b>	<b>STANDARD DESIGN WITH THIRD-PARTY VERIFICATION OF EXISTING CONDITIONS SHALL BE BASED ON</b>
Ceiling insulation, wall insulation, and raised-floor insulation	The requirements of Sections 150.0(a), (c), and (d)	The existing insulation <i>R</i> -value
Fenestration	The <i>U</i> -factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.	If the proposed <i>U</i> -factor is $\leq 0.40$ and SHGC value is $\leq 0.35$ , the standard design shall be based on the existing <i>U</i> -factor and SHGC values as verified. Otherwise, the standard design shall be based on the <i>U</i> -factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.
Window film	The <i>U</i> -factor of 0.40 and SHGC value of 0.35.	The existing fenestration in the alteration shall be based on Tables 110.6-A and 110.6-B.
Doors	The <i>U</i> -factor of 0.20. The door area shall be the door area of the existing building.	If the proposed <i>U</i> -factor is $< 0.20$ , the standard design shall be based on the existing <i>U</i> -factor value as verified. Otherwise, the standard design shall be based on the <i>U</i> -factor of 0.20. The door area shall be the door area of the existing building.
Space-heating and space-cooling equipment	Table 150.1-A or B for equipment efficiency requirements; Section 150.2(b)1C for entirely new or complete replacement systems; Section 150.2(b)1F for refrigerant charge verification requirements.	The existing efficiency levels.
Air distribution system – duct sealing	The requirements of Sections 150.2(b)1D and 150.2(b)1E	
Air distribution system – duct insulation	The proposed efficiency levels.	The existing efficiency levels.
Water heating systems	The requirements of Section 150.2(b)1Hii.	The existing efficiency levels.
Roofing products	The requirements of Section 150.2(b)II.	
All other measures	The proposed efficiency levels.	The existing efficiency levels.

## HISTORY NOTE APPENDIX

### 2019 California Energy Code California Code of Regulations, Title 24, Part 6

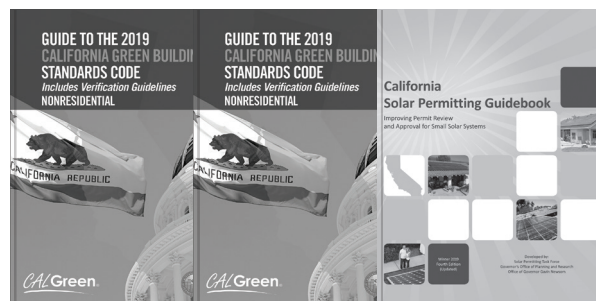
For prior history, see History Note Appendix to the 2016 *California Energy Code*, effective January 1, 2017.

1. (CEC 02/18) Update of 2016 building energy efficiency standards to repeal, amend and add sections of the standards, to (among other things) increase the efficient use of energy and water in buildings, and to further the State's policy goals of achieving zero net energy consumption of energy by buildings. Approved by the California Building Standards Commission on December 5, 2018; filed with the Secretary of State December 7, 2018, and effective January 1, 2020.

2. Erratum to correct editorial errors in Subchapters 3 through 5, and 7 through 9, effective January 1, 2020.



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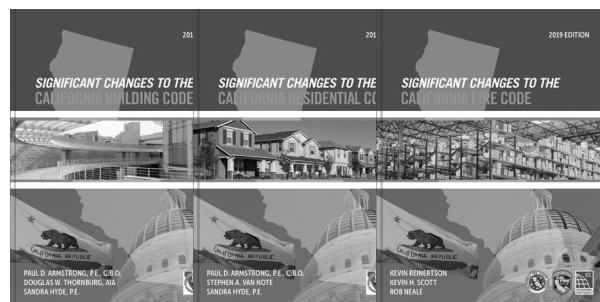
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