Errata 1 changes to the *2019 Residential Compliance Manual*

This errata addresses twenty suggested revisions to the 2019 Residential Compliance Manual (RCM) along with minor changes to correct grammatical errors, clarify meaning, or generally clean up otherwise confusing language. Page numbers refer to the 2019 Residential Compliance Manual posted at https://www.energy.ca.gov/media/3963. The text below shows changes in underline-strikeout. Added text is shown in underline; ~~deleted text shown in strikeout~~. This change document is not comprehensive and does not provide all of the minor changes (such as typos and formatting corrections) made that do not alter the meaning of the RCM. The revised RCM contains vertical change bars in the margins of each page to indicate a location where the manual has been altered.

Chapter 1, p. 1-6

Roof/ceiling insulation and radiant barrier requirements for prescriptive additions with 700 square feet or less ~~follow Option C (R-38 in Climate Zones 1, 11-16, or R-30 and radiant barrier in Climate Zones 2-10) (§150.2(a)1B)~~ require R-38 in Climate Zones 1, 11-16; or R-30 in Climate Zones 2-10; and a radiant barrier in Climate Zones 2-15 (§150.2[a]1B).

Chapter 1, p. 1-9, Table 1-2

Dormitories or other congregate residences, or any building with dormitory-style sleeping quarters, with ~~six or more "guest rooms"~~four or more habitable stories

Chapter 1, p. 1-11

Additional information about the CHBC can be found at~~on the following website:~~ https://www.dgs.ca.gov/DSA/Resources/Page-Content/Resources-List-Folder/SHBSB ~~http://www.dgs.ca.gov/dsa/AboutUs/shbsb.aspx~~

Chapter 1, p. 1-23

Publications, including the ~~2016~~ 2019 Building Energy Efficiency Standards, the ~~*2016*~~ *2019 Reference Appendices*, and the ~~*2016*~~ *2019 Residential ACM Approval and Reference Manuals,* and others, are available from the Energy Commission's website at http://www.energy.ca.gov/title24. Paper copies may also be ordered from:

Publications Unit
California Energy Commission
1516 Ninth Street, MS-13
Sacramento, CA 95814
(916) 654-5200

Chapter 1, p. 1-25

Manufacturers whose insulating materials are certified for sale in California are listed in the Department of Consumer Affairs' *Consumer Guide and Directory of Certified Insulation Material*. Each building department receives a copy of this directory. If an insulating product is not listed in the directory, or if you want to purchase a directory, contact the Department of Consumer Affairs, Bureau of Household Goods and Services (BHGS)~~Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation (BEARHFTI)~~, at (916) 999-2041.

Chapter 1, p. 1-26

The Energy Commission has a series of streaming videos that explain energy efficiency concepts and the application of the Energy Standards. These videos cover topics including plan checking, field inspection, HVAC, HERS, water heating, building envelope, and renewable energy. They can be viewed at https://www.energy.ca.gov/title24/orc/~~http://www.energyvideos.com~~.

Chapter 2, p. 2-3

The energy compliance documentation has been revised and reorganized. Prescriptive versions of the certificate of compliance (CF1R) have been designed to be used specifically with:

1. Residential Newly Constructed Buildings (CF1R-NCB-01)
2. Residential Additions (CF1R-ADD-01)
3. Residential Alterations (CF1R-ALT-01)
4. Residential HVAC Changeouts (CF1R-ALT-02)
5. Solar Water Heating Worksheet (CF1R-~~SRA~~STH-01)

The certificate of installation (CF2R) is separated into:

1. Envelope (CF2R-ENV)
2. Lighting (CF2R-LTG).
3. Mechanical (CF2R-MCH)
4. Plumbing (CF2R-PLB)
5. Solar Photovoltaic and Battery Storage, Solar-~~-~~Ready Zone Area, and Solar Thermal Water Heating (CF2R- PVB, SRA, ~~SPV~~ and ~~CF2R-~~STH, respectively)

Chapter 2, p. 2-20

Chapter 9 of the *Business and Professions Code* specifies ~~that for that chapter,~~ the term "contractor" is synonymous with the term "builder." This manual uses "builder" to refer to the general contractor responsible for construction. For production homes, the builder may also be the developer ~~with~~ responsible~~ility~~ for arranging financing, acquiring the land, subdividing the property, securing the

necessary land planning approvals, and attending to the other necessary tasks that are required before actual construction. Many production builders are involved in marketing and sales of homes after they are constructed.

Chapter 2, p. 2-32

The following features require field verification and/or diagnostic testing:

a. Duct sealing
b. ~~Supply d~~Duct location, surface area and R-value
c. Low-leakage ducts entirely in conditioned space
d. Low-leakage air handlers
e. Verification of return duct design
f. Verification of air filter device design, filter MERV rating, and labeling
g. Verification of prescriptive bypass duct ~~prohibition~~requirements
h. Refrigerant charge in ducted split-system and ducted packaged unit air conditioners and heat pumps, and mini-split systems
i. Refrigerant fault indicator display (FID)
j. Verified system airflow
k. Air handler fan efficacy
l. Verified energy efficiency ratio (EER)
m. Verified seasonal energy efficiency ratio (SEER)
n. Heat Pump Rated Heating Capacity
~~o. Maximum rated total cooling capacity~~
~~p.~~o. Evaporatively ~~-~~cooled condensers
p. Whole-~~-~~house fan
q. Central fan ~~integrated~~ ventilation cooling systems
~~q. Ice storage air conditioners~~
r. Continuous whole-building mechanical ventilation airflow
s. Intermittent whole-building mechanical ventilation airflow
t. Kitchen range hood verification~~HVI listing for airflow and noise (sones)~~
~~t.~~u. Building envelope air leakage
~~u.~~v. ~~High-q~~Quality insulation installation (QII)
~~v.~~w. Quality insulation installation for spray polyurethane foam
x. Verified pipe insulation credit (PIC-H)
~~w. PV field verification protocol~~
~~x. Kitchen hood HVI listing for airflow and noise (sones)~~
y. Verified central parallel piping (PP-H)
~~z. Central fan integrated ventilation cooling systems~~

~~aa. Whole house fan~~

~~bb. Zonal controls~~

~~cc.~~z. Verified compact hot water distribution system expanded credit (CHWDS-H-EX)

~~dd. Verified pipe insulation credit~~

~~ee. Verified drain water heat recovery system~~

~~ff. Verified point of use~~

~~gg.~~aa. Demand recirculation: manual control (R-DRmc-H)

~~hh.~~bb. Demand recirculation: sensor control (R-DRsc-H)

cc. Multiple recirculation loop design for DHW systems serving multiple dwelling units

~~ii.~~dd. Verified drain water heat recovery system (DWHR-H)

Chapter 3, p. 3-11

When fenestration is not rated by the NFRC, the values found in Energy Commission Default Tables 110.6-A and 110.6-B in the Energy Standards ~~list the worst-case values that~~ must be ~~assumed in most cases when fenestration is not rated by NFRC~~used. For example, a single-pane, operable, metal-framed fenestration product has a default U-factor of 1.28. To get credit for high-performance window features such as low-emissivity (low-e) coatings and thermal break frames, the window manufacturer must have the window tested, labeled, and certified according to NFRC procedures. When the Energy Standards default values are used, they must be documented on a temporary default label (Figure 3-3).

Chapter 3, p. 3-38

The radiant barrier must have an emittance of 0.05 or less. The product must be tested according to ASTM C1371 or ASTM E408, ~~and must be~~ certified by the Bureau of Household Goods and Services (BHGS), ~~California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation~~ and listed in its Consumer Guide and Directory of Certified Insulation Material, at https://bhgs.dca.ca.gov/consumers/ti_directory.pdf~~http://www.bearhfti.ca.gov/industry/thermal_insulation.shtml~~.

Chapter 3, p. 3-62

The prescriptive requirements in Table 150.1-A and Table 150.1-B call for a U-factor of 0.048 for single-family homes and 0.051 for multifamily buildings in Climate Zones 1-5 and 8-16, and a U-factor of 0.065 in Climate Zones 6 and 7 for both building types.

Chapter 3, p. 3-74

Headers shall meet one of the following criteria for QII:

a. Two-member header with insulation in between. The header and insulation must fill the wall cavity. There are prefabricated products available that meet this assembly. Example: a 2x4 wall with two 2x nominal headers, or a 2x6 wall with a 4x nominal header and a 2x nominal header. Insulation is required to fill the wall cavity and must be installed between the headers.

b. Two-member header, less than the wall width, with insulation on the interior face. The header and insulation must fill the wall cavity. Example: a 2x6 wall with two 2x nominal headers. Insulation is required to fill the wall cavity and must be installed to the interior face of the wall.

c. Single-member header, less than the wall width, with insulation on the interior face. The header and insulation must fill the wall cavity. Example: a 2x4 wall with a 3-1/8-inch-wide header, or 2x6 wall with a 4x nominal header. Insulation is required to fill the wall cavity and must be installed to the interior face of the wall.

d. Single-member header, same width as wall. The header must fill the wall cavity. Example: a 2x4 wall with a 4x nominal header or a 2x6 wall with a 6x nominal header. No additional insulation is required provided that the entire wall has at least R-2 continuous rigid insulation installed on the exterior~~because the header fills the cavity~~.

Chapter 4, p. 4-39

Forced-air systems that provide cooling must comply with either the airflow rate and fan efficacy verification, or may comply with the return duct design specifications given in Tables 150.0-~~C~~ B and ~~D~~C.

Chapter 4, p. 4-48

An exception to Section 150.0(m)13C allows single-~~-~~speed compressor systems to comply with HERS verification of the *mandatory* AF/FE requirements only at the highest fan speed when all zones call for cooling.~~,~~ The exception applies provided the system also uses the *performance* compliance approach and complies with HERS verification of the requirements for AF/FE in all zonal control modes specified by the software user input for minimum airflow rate when fewer than all zones ca~~l~~ll for cooling. Single-speed compressor systems, with or without bypass dampers, are less likely to meet the *mandatory* AF/FE requirements in Section 150.0(m)13C with fewer than all zones calling for cooling.~~;~~ Therefore, the performance compliance software calculates a penalty for the reduced airflow (specified by the user) during operation when fewer than all zones ca~~l~~ll for cooling. Other energy features for the building must offset this penalty for reduced airflow when fewer than all zones call for cooling. In the performance compliance software, if the system is modeled as a zoned system with a single-speed compressor, the minimum allowable airflow drops to 150 CFM/ton. But because the standard house is assumed to have an airflow of 350 CFM/ton, there is a penalty imposed on the compliance calculation unless the designer specifies a value of 350 or higher. Entering a value between 150 and 350 can lessen the penalty resulting from the minimum allowed value of 150 CFM/ton.

Chapter 4, p. 4-74

As specified by §150.0(o), single-family detached dwelling units, and multifamily attached dwelling units must meet the requirements of ASHRAE Standard 62.2-2016 including Addenda b, d, l, q, and s (ASHRAE 62.2), subject to the amendments specified in Section 150.0(o)1. A copy of this version of ASHRAE 62.2 may be obtained at the following URL: https://www.techstreet.com/ashrae/standards/california-energy-commission-adopted-version-of-ansi-ashrae-standard-62-2-2016?product_id=2033702~~[insert link to ASHRAE bookstore for this version of ASHRAE 62.2 when it becomes available]~~

Chapter 4, p. 4-91

Example 4-11 – Required Ventilation

Question:

What is the required continuous ventilation rate for a three-bedroom, 1,800 ft² townhouse located in Climate Zone 8 that has 9-foot ceilings, and where 25% of the exterior wall surface area adjoins another unit? Ventilation is provided by a bathroom exhaust fan. No extraordinary measures have been taken to seal the building.

Answer:

Equation 4-1 yields a total ventilation rate of 84 CFM

$$Q_{tot} = 0.03A_{floor} + 7.5(N_{br} + 1) = 0.03(1800) + 7.5(3 + 1) = 84 \text{ CFM}$$

The volume is 1,800 x 9 = 16,~~3~~200 ft^3. Solving for Equation 4-2 results in a leakage rate of ~~543~~ 540 CFM

$$Q_{50} = \text{Vdu x 2 ACH50/ 60} = 16,\text{~~300~~ 200 x 2/60} = 540 \text{ CFM}$$

Using Equation 4-3: $Q_{inf} = 0.052 \times Q_{50} \times wsf \times [H/H_r]^{\text{~~2~~0.4}}$ ~~=~~ = 0.05~~3~~2 x 540 x 0.36 x (18/8.2)$^{0.4}$ = 14 C~~F~~M

And applying Equation 4-4, the mechanical ventilation system must move 82 CFM.

$$Q_{fan} = Q_{tot} - (Q_{inf}/Q_{tot})(Q_{inf} \times A_{ext}) = 84 - (\text{~~23~~14}/84)(\text{~~23~~14} \times (1-0.25) = 82 \text{ CFM}$$

Due to the reduction in infiltration resulting from reduced exterior wall area and to the use of an exhaust fan instead of a balanced system, the effective infiltration credit is only 2 CFM.

Chapter 4, p. 4-147

For the performance compliance approach, the required features are based on a set of features that the designer has documented to result in a level of efficiency at least as good as the prescriptive component package ~~A~~for single-family and multifamily. The calculations for documenting this are done using the approved performance compliance software. The calculation approach is described in the

Alternative Calculation Method (ACM) Reference Manual.

Chapter 4, p. 4-148

Special features requiring HERS Rater verification:

1. Duct sealing
2. Verified duct design – for reduced duct surface area and ducts in conditioned space
3. Low-leakage ducts in conditioned space
4. Low-leakage air handlers
5. Verification of return duct design
6. Verification of air filter device design
7. Verification of bypass duct prohibition
8. Refrigerant charge verification
9. Installation of a fault indicator display (FID)
10. Verified system airflow
11. Air handler fan watt draw
12. High energy efficiency ratio (EER)
13. Verified seasonal energy efficiency ratio (SEER)
14. Heating seasonal performance factor (HSPF)
15. Heat pump - rated heating capacity
16. Continuous dwelling unit mechanical ventilation airflow for IAQ
17. Intermittent dwelling unit mechanical ventilation airflow for IAQ
18. Kitchen range hood verification for IAQ
19. Building or dwelling unit enclosure air leakage
20. ~~High q~~Quality insulation installation (QII)
21. Whole-house fan airflow and fan efficacy
22. Central fan ventilation cooling system verification

Chapter 5, p. 5-10

The Energy Commission has developed a water heater efficiency guide to allow quick lookup of the minimum efficiency of the most common types and sizes of water heaters. It is available to download at ~~here: http://www.energy.ca.gov/title24/orc/waterheating/2019_waterheating.html#resguides~~https://www.energy.ca.gov/sites/default/files/2020-07/2019_WaterHeating_Guide.pdf.

Chapter 5, p. 5-20

Where insulation is required as described above, 1 inch of insulation is typically required. This requirement applies to domestic hot water pipe (above 105° F) when the pipe diameter is less than 1 inch ~~or smaller~~, the water temperature is between 105°F and 140°F, and the insulation conductivity is between 0.22 and 0.28 BTU-in/hr-ft²-°F (typical of cellular foam pipe insulation material). One and one-half inch insulation is required on pipes ~~greater than~~ 1 inch or greater. For other situations refer to Table 120.3-A.

Chapter 5, p. 5-22

Example 5-1 − Distribution Systems

Question:

When I'm insulating the pipes for a recirculating water heating system, I understand that I must insulate the entire length of hot water pipes that are part of the recirculation loop. Do I also need to insulate the runouts?

Answer:

Yes, per the California Plumbing Code domestic hot water piping shall be insulated~~No, other than the pipe to the kitchen fixture as it is a mandatory requirement. Since the water in runouts does not recirculate, other runouts do not need to be insulated~~.

Chapter 5, p. 5-28

Figure 5-7 shows a~~A~~ dual-loop design ~~is illustrated in Figure 5-7~~. In a dual-loop design, each loop serves half of the dwelling units. According to plumbing code requirements, the pipe diameters can be downsized compared to a loop serving all dwelling units. The total pipe surface area is effectively reduced, even though total pipe length is about the same as or somewhat greater than that of a single-loop design. For appropriate pipe sizing guidelines, please refer to the ~~Universal~~ California Plumbing Code.

Chapter 6, p. 6-9

Night lights, step lights and path lights ~~can be installed by complying with the residential lighting requirement of the Energy Code by~~must either:

1. Be rated to consume no more than 5 watts and emit no more than 150 lumens; or~~The luminaire complies with Table 150.0-A (A short version of the table is at page 6-4);~~
2. Comply with Table 150.0-A (a short version of the table is available on page 6-4) and be controlled by vacancy sensors~~The luminaire is controlled by a vacancy sensor as required under Section 150.0(k)2I in applicable spaces (bathrooms, garages, laundry rooms and utility rooms). It is rated no more than 5 watts (W) of power and emits no more than 150 lumens~~.

Chapter 6, p. 6-9

Light sources in drawers, cabinets, and linen closets ~~can be installed by complying with the residential lighting requirement of the Energy Code by~~must either:

1. Be rated to consume no more than 5 watts and emit no more than 150 lumens, and be equipped with controls that automatically turn the light off when the drawer, cabinet, or linen closet is closed; or~~The luminaire complies with Table 150.0-A (A short version of the table is at page 6-4) ;~~
2. Comply with Table 150.0-A (a short version of the table is available on page 6-4) and be controlled by vacancy sensors~~The luminaire is controlled to be automatically off when the drawer, cabinet or linen closet is closed, and is also controlled by a vacancy sensor as required under Section 150.0(k)2I in applicable spaces (bathrooms, garages, laundry rooms and utility rooms). The luminaire is rated no more than 5W of power and emits no more than 150 lumens~~.

Chapter 7, p. 7-20

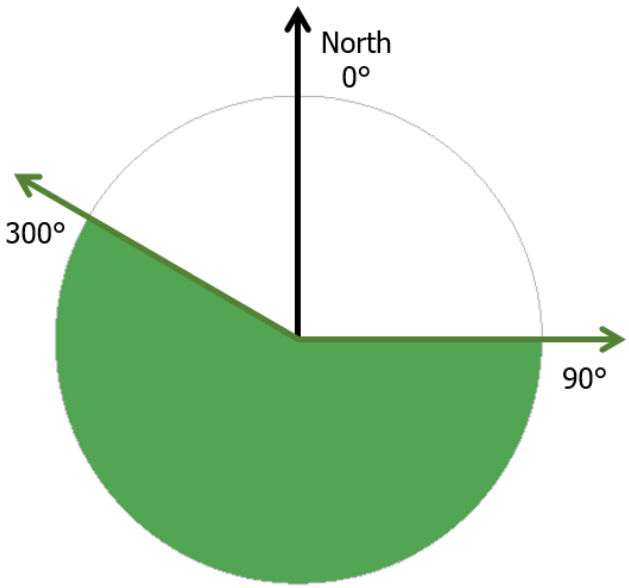
The solar~~-~~-ready provisions are mandatory for low-rise residential buildings that do not have a solar PV system, most commonly due to an exception to the prescriptive PV requirements in Section 150.1(c)14. There are also exceptions to the “solar zone” requirements, and these are described in the corresponding sections of this chapter. These exceptions remove the need to reserve a portion of the roof area as a solar zone.~~,~~ However, the requirements relating to the main electrical service panel and ~~to~~ reserved areas for inverters, metering equipment, and interconnection pathways to the electrical service will still apply. For this reason~~Because solar ready is mandatory~~, ~~CF1R~~CF2R-SRA-01-E compliance forms must be submitted with the building permit application, even when using an allowable solar zone exception.

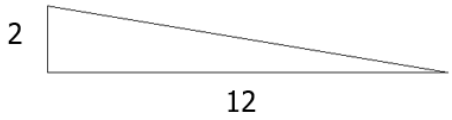
Chapter 7, p. 7-22

Submit a ~~CF1R~~CF2R-SRA-01-E to the building department ~~with the building permit application~~ for all projects that do not include a solar photovoltaic system~~covered by solar ready~~, even when using an exception to solar zone requirements~~Exception~~. In addition, submit a ~~CF1R~~CF2R-SRA-02-E solar zone worksheet for all projects with a solar zone, including exceptions that allow a reduced solar zone area.~~–~~

Chapter 7, p. 7-27
Updated the figure illustration

Figure 7-4: Orientation when solar zone is located on a steep-sloped roof





If solar zone is located on a sloped roof with a rise to run ratio greater than 2:12 (see above), then the roof must face between 90° and 300°

Chapter 7, p. 7-29

A copy of the construction documents or a document containing the required solar-ready information must be provided to the occupant. The building occupant must also receive a copy of the associated installation~~compliance~~ forms ~~CF1R~~CF2R-SRA-01-E and ~~CF1R~~CF2R-SRA-02-E. Providing this information to the building occupant is required so the information is available if the owner decides to install a solar energy system in the future. Construction documents must include information about the as-designed structural loads, solar zone location, and the reserved interconnection pathways. This requirement applies to ~~both~~ single-family residential and low-rise multifamily buildings.

Chapter 7, p. 7-30

The entire Solar Photovoltaic Installation Guideline can be accessed at-
~~http://osfm.fire.ca.gov/pdf/reports/solarphotovoltaicguideline.pdf~~
http://opr.ca.gov/docs/20190226-Solar_Permitting_Guidebook_4th_Edition.pdf

Chapter 7, p. 7-32

When a building permit application is submitted to the enforcement agency, the applicant also submits plans and energy compliance documentation. This section describes the forms and procedures for documenting compliance with the solar ready requirements of the Energy Standards. The following discussion is addressed to the designer preparing construction and compliance documents, and to the enforcement agency plan checkers who are examining those documents for compliance with the standards.
There are three~~four~~ forms associated with the low-rise residential solar-ready requirements. Each form is briefly described below.

1. **CF2R-SRA-01-E:** Certificate of Installation~~Compliance~~: ~~Residential~~ Solar-Ready Buildings~~Areas~~

This form is required for ~~every project where the solar-ready requirements apply:~~ newly constructed single-family residential and low-rise multifamily projects that do not include solar PV systems~~buildings~~. This form documents what was installed to comply with the solar-ready requirements, including any equipment installed to qualify for one of the solar zone exceptions.

2. **CF2R-SRA-02-E:** Certificate of Installation~~Compliance~~: Minimum Solar Zone Area Worksheet

This form is required when buildings comply with the solar-ready requirement by including a solar zone. That is, an appropriately sized solar PV system is not installed, an appropriately sized solar water heating system is not installed, the building does not comply with all the OCST ~~and high-efficacy lighting~~ requirements, or the roof is not designed for vehicle traffic or a heliport.

3. **CF2R-STH-01-E:** Certificate of Installation: ~~–~~ Solar Water Heating System Single-Family Residential Only: This form is required when ~~the building is using solar zone Exception 1 because~~ a compliant solar water-heating system has been installed on the home to meet solar zone Exception 1.

Chapter 9, p. 9-1

The chapter is organized as follows:

1. **Section 9.1 – Introduction.** Highlights the applicable standards definitions for additions, alterations, and repairs and provides several examples of each.
2. **Section 9.2 – What's New in the 2019 Energy Standards.** Highlights of the requirements and compliance options in the 2019 Energy Standards.
3. **Section 9.3 – Compliance Approaches.** An overview of prescriptive and performance compliance options.
4. **Section 9.4 – Prescriptive Approach and Mandatory Measures.** Detailed information on prescriptive compliance methods for additions and alterations, including how mandatory measures apply.
5. **Section 9.5 – Performance Approach~~Method~~.** An explanation of computer compliance approaches for additions, including existing + addition + alterations.

~~1. **Section 9.7 – Alterations.** Detailed information on prescriptive and performance compliance methods.~~

~~2. **Section 9.8 – Mandatory Requirements.** Mandatory requirements for additions and alterations.~~

When additions and alterations include changes to the envelope, mechanical systems, and/or water heating systems, a certificate of compliance must be completed prescriptively or be generated by compliance software with the performance approach. The prescriptive certificate of compliance is the CF1R-

ADD-01 or CF1R-ALT-02 form. (See Appendix A for a full list of forms.)

Chapter 9, p. 9-21

Table 9-5: Envelope Wall/Floor Insulation Requirements for Prescriptive Additions

Component	Additions ≤ 400 ft^2	Additions > 400 and ≤ 700 ft^2	Additions > 700 ft^2
Exterior framed wall[1] insulation – single-family	CZ 1-5, 8-16: U = 0.048 CZ 6-7: U = 0.065	Same as ≤ 400 ft^2	Same as ≤ 400 ft^2
Exterior framed wall[1,2] insulation - multifamily	CZ 1-5, 8-16: U = 0.051 CZ 6-7: U = 0.065	Same as ≤ 400 ft^2	Same as ≤ 400 ft^2
Extension of existing wood-framed wall Or Existing wood-framed wall with exterior siding (or cladding) to remain	R-15 in 2x4 wood framing R-21 in 2x6 wood framing	Same as ≤ 400 ft^2	Same as ≤ 400 ft^2
Raised floor[1] insulation	All CZs: R-19 or U = 0.037	Same as ≤ 400 ft^2	Same as ≤ 400 ft^2
Slab floor[1] perimeter insulation	CZ 1-15: No requirement CZ 16: R-7 or U = 0.58	Same as ≤ 400 ft^2	Same as ≤ 400 ft^2

1. See Table 150.1-A and 150.1-B for requirements for floors and ~~non-framed~~ walls including mass walls

~~2. *R-values refer to wood framing, and U-factors refer to metal framing*.~~

Chapter 9, p. 9-25

Table 9-8: For Residential Alterations, Summary of Mandatory and Prescriptive Measures

Envelope Alteration Type	Applicable Mandatory Measures[1]	Summary of Relevant Prescriptive Measure(s)[2]	Exception(s) to the Prescriptive Measures
Adding ceiling insulation to an existing roof; or a new roof on an existing building	Ceiling w/ attic and roof rafters: R-19, U=0.054 §150.0(a)	N/A	N/A
Adding exterior framed wall insulation	In 2x4 framing: R-13, U=0.102 In 2x6 framing: R-20, U=0.071 *Exception: 2x4 framing already insulated to R-11 or greater per §150.0(c)1* ~~Exception: Walls already insulated to R-11 §150.1(c)~~	Same as mandatory	N/A
Mass/concrete walls	See §150.1(c) for applicable climate zone	Same as mandatory	N/A
Replacing > 50% of existing roof surface, including adding a new surface layer on top of existing exterior surface	§110.8(i)	Steep-Sloped (≥ 2:12): CZ 10~~-~~15: Reflectance ≥ 0.20 and Emittance ≥ 0.75; or SRI ≥ 16	(a) Air space 1.0" between roof deck and bottom of roofing product (b) Profile ratio of rise to width of 1:5 for >50% width of roofing product. (c) Existing ducts in attic insulated and sealed per §150.1(c)9. (d) Roof has ≥ R-38 ceiling insulation. (e) Roof has a radiant barrier per §150.1(c)2. (f) No ducts in attic. (g) In CZ10-15, >R-2.0 insulation above roof deck
Replacing > 50% of existing roof surface, including adding a new surface layer on top of existing exterior surface	§110.8(i)	Low-Sloped (< 2:12): CZ13 & 15: Reflectance ≥ 0.63; Emittance ≥ 0.75; or SRI ≥ 75	(a) There are no ducts in the attic. (b) Reflectance and ~~R~~roof ~~D~~deck ~~I~~insulation R-value in Table 150.2-B~~A~~ are met.

Table 9-8: For Residential Alterations, Summary of Mandatory and Prescriptive Measures
(continued)

Envelope Alteration Type	Applicable Mandatory Measures[1]	Summary of Relevant Prescriptive Measure(s)[2]	Exception(s) to the Prescriptive Measures
Adding or replacing skylight[3]	Must have a maximum U-factor ≤ 0.58 OR Weighted average of all fenestration including skylight products U-factor ≤ 0.58 per §150.0(q) Exception 1: Up to ~~20~~ 10 ft² or 0.5% of conditioned floor area, whichever is greater, is exempt from the U-factor requirement of §150.0(q)	Must not exceed 20% total (all CZs) and 5% west fenestration area (CZ 2, 4, 6-15) with a U-factor ≤ 0.30 (all CZs); in CZ 2, 4 & 6-15: SHGC ≤ 0.23 per §150.2(b)1A	Up to 75 ft² of new skylight area does not need ~~not~~ to meet the total ~~or~~ and west-facing fenestration area requirements of §150.2(c)3B and C per §150.2(b)1A Exception 1 Added~~Replacement~~ skylights with up to 16 ft² of new skylight area with a U-factor ≤ 0.55 and SHGC ≤ 0.30 does~~and~~ not need to meet total ~~fenestration~~ and west-facing fenestration area requirements per §150.2(b)1A Exception 2 Replacement skylights must meet a U-factor ≤ 0.55 and SHGC ≤ 0.30 per §150.2(b)1B Exception 2
Adding raised floor insulation	R-19 or equivalent U-factor Exception: Floors over controlled ventilation or unvented crawlspaces per §150.0(d)	Same as mandatory	N/A
Replacing vertical fenestration[3] (altered glazing)	Must have a maximum U-factor ≤ 0.58 OR Weighted average of all fenestration including skylight products U-factor ≤ 0.58 per §150.0(q) Exemption 1: Up to 10 ft² or 0.5% of conditioned floor area, whichever is greater, is exempt from the U-factor requirement of §150.0(q)1	~~Must not exceed 20% total (all CZs) and 5% west fenestration area (CZ 2, 4, 6-15) with a~~ U-factor ≤ 0.30 (all CZs); in CZ2, 4 & 6-15: SHGC ≤ 0.23 per §150.2(b)1B~~A~~ SHGC requirements can also be met by installing shading per §150.2(b)1B	*Up to 75 ft² of replacement fenestration may have a U-factor ≤ 0.40 (all CZs) and SHGC ≤ 0.35 in CZ 2, 4, and 6-15~~need not meet total or west-facing fenestration area~~ per §150.2(b)1B~~A~~ Exception 1* ~~Replacement skylights up to 16 ft² with a U≤0.55 and SHGC ≤0.30 and not meet total fenestration and west-facing area requirements per §150.2(b)1A Exception 2~~

Envelope Alteration Type	Applicable Mandatory Measures[1]	Summary of Relevant Prescriptive Measure(s)[2]	Exception(s) to the Prescriptive Measures
Adding vertical fenestration[3] (new glazing) and greenhouse or garden windows	Must have a maximum U-factor ≤ 0.58 OR Weighted average of all fenestration including skylight products U-factor ≤ 0.58 per §150.0(q) Exc~~em~~ption 1: Up to 10 ft^2 or 0.5% of conditioned floor area, whichever is greater, is exempt from the U-factor requirement of §150.0(q)1 Exception 2: Added greenhouse or garden windows up to 30 ft^2 are exempt from the U-factor requirement of §150.0(q)1	Must not exceed 20% total (all CZs) and 5% west fenestration area (CZ 2, 4, 6-15) with a U-factor ≤ 0.30 (all CZs); in CZ 2, 4 & 6-15: SHGC =≤ 0.23 per §150.2(b)1A	*Up to 75 ft^2 need not meet total or west-facing fenestration area per §150.2(b)1A Exception 1* ~~Added greenhouse must either meet the maximum or weighted average U-factor of 0.58 or up to 10ft^2 or 0.5% of CFA whichever is greater as per Exception 1 to §150.0(q)1~~

1. Alterations must comply with all applicable mandatory measures in §110.0 and §150.0 of the Energy Standards as explained in Chapters 3, 4, 5 and 6 of this manual, except as noted in §150.2(b).
2. Several prescriptive measures are climate zone (CZ) specific.
3. Replacement fenestration may include fenestration that is located in the same existing wall or roof in which the same or larger area of existing fenestration is being removed. This is labeled as “altered.” Any new fenestration area that increases the total net area of fenestration in any existing wall or roof is labeled as “new.”

Chapter 9, p. 9-27

In Climate Zones 10 through 15, if 50 percent or more of the roof surface of an existing building is being replaced, the minimum cool roof requirement for the replaced steep-sloped roofing area shall have an aged solar reflectance of 0.20, thermal emittance equal to 0.75, or a minimum SRI of 16. The requirements above apply unless one of the following is present (considered equivalent to the cool roof requirements in §150.2~~([~~[b]~~)~~1~~I~~~~H~~i):

Chapter 9, p. 9-27

In Climate Zones 13 and 15, if 50 percent or more of the roof surface of an existing building is being replaced, the minimum cool roof requirements for low-sloped roofs shall have an aged solar reflectance of 0.63, thermal emittance of 0.75, or a minimum SRI of 75 per §150.2(b)1~~H~~Iii. These apply unless one of the following is present, which is considered equivalent to the cool roof requirements in §150.2(b)1~~H~~Iii:

Chapter 9, p. 9-29

The prescriptive requirement for alterations to walls and floors is to add the equivalent of the specified level of insulation that fits within the cavity of wood-framed assemblies:

1. R-~~15~~ 13 in 2x4 exterior walls, and R-~~21~~ 20 in 2x6 or greater exterior walls (no exterior continuous insulation is required); or

2. Existing ~~buildings~~ 2x4 exterior walls that already have R-11 insulation installed in framed walls are exempt from the mandatory minimum R-13 ~~or R-20~~ wall insulation required by §150.0(c)6 ~~if the building can demonstrate performance compliance with the walls modeled as R-11~~; or

3. R-19 in raised floors over crawl spaces, over open outdoor areas, unheated basements, and garages.

Doc Type	Doc Category	Category Description	Document Description
CF1R's – Certificate of Compliance	X	X	X
CF1R-	ADD-01-E	Additions	Prescriptive Additions Less Than 1,000 ft^2
CF1R-	ADD-02-E	Additions	Prescriptive Additions – Simple NonHERS (paper version)
CF1R-	ALT-01-E	Alterations	Prescriptive Alterations
CF1R-	ALT-02-E	Alterations	Prescriptive Alterations HVAC
CF1R-	ALT-05-E	Alterations	Prescriptive Alterations – Simple NonHERS (paper version)
CF1R-	ENV-02-E	Envelope	Area Weighted Average Calculation Worksheet
CF1R-	ENV-03-E	Envelope	Solar Heat Gain Coefficient (SHGC) Worksheet
CF1R-	ENV-04-E	Envelope	Solar Reflective Index (SRI) Worksheet
CF1R-	ENV-05-E	Envelope	Alternative Default Fenestration Procedure (NA6) Worksheet
CF1R-	ENV-06-E	Envelope	Interior and Exterior Insulation Layers Worksheet
CF1R-	NCB-01-E	Newly Constructed Buildings	Prescriptive Newly Constructed Buildings and Additions Equal to or Greater Than 1,000 ft^2
CF1R-	PLB-01-E	Plumbing (DHW)	Hydronic Heating System Worksheet

Doc Type	Doc Category	Category Description	Document Description
CF1R-	PRF-01-E	Performance	Residential Performance Compliance Method
CF1R-	STH-01-E	Solar Thermal	OG 100 Solar Water Heating Worksheet
CF2R's – Certificate of Installation	X	X	X
CF2R-	ADD-02-E	Additions	Prescriptive Additions – Simple NonHERS (paper version)
CF2R-	ALT-05-E	Alterations	Prescriptive Alterations – Simple NonHERS (paper version)
CF2R-	ENV-01-E	Envelope-NonHERS	Fenestration Installation
CF2R-	ENV-03-E	Envelope-NonHERS	Insulation Installation
CF2R-	ENV-04-E	Envelope-NonHERS	Roofing – Radiant Barrier
CF2R-	ENV-20-H	Envelope-HERS	Building Leakage Diagnostic Test
CF2R-	ENV-21-H	Envelope-HERS	QII - Framing Stage
CF2R-	ENV-22-H	Envelope-HERS	QII – Insulation Installation Stage
CF2R-	LTG-01-E	Lighting-NonHERS	Lighting - Single--Family Dwellings
CF2R-	LTG-02-E	Lighting-NonHERS	Lighting - Multifamily Dwellings
CF2R-	MCH-01-E	Mechanical-NonHERS	Space Conditioning Systems
CF2R-	MCH-02-E	Mechanical-NonHERS	Whole House Fan
CF2R-	MCH-04-E	Mechanical-NonHERS	Evaporative Coolers
CF2R-	MCH-20-H	Mechanical-HERS	Duct Leakage Diagnostic Test
CF2R-	MCH-21-H	Mechanical-HERS	Duct Location Verification
CF2R-	MCH-22-H	Mechanical-HERS	Fan Efficacy
CF2R-	MCH-23-H	Mechanical-HERS	Airflow Rate
CF2R-	MCH-24-H	Envelope-HERS	Building Envelope Air Leakage Worksheet

Doc Type	Doc Category	Category Description	Document Description
CF2R-	MCH-25-H	Mechanical-HERS	Refrigerant Charge Verification
CF2R-	MCH-26-H	Mechanical-HERS	Rated Space Conditioning System Equipment Verification
CF2R-	MCH-27-H	Mechanical-HERS	Indoor Air Quality and Mechanical Ventilation
CF2R-	MCH-28-H	Mechanical-HERS	Return Duct Design and Air Filter Grille Device Sizing According to Tables 150.0-B or C
CF2R-	MCH-29-H	Mechanical-HERS	Duct Surface Area Reduction; R-Value; Buried Ducts Compliance Credit
CF2R-	MCH-30-E	Mechanical-HERS	Ventilation cooling compliance credit
CF2R-	MCH-31-H	Mechanical-HERS	HERS Verified Whole House Fan
CF2R	MCH-32-H	Mechanical-HERS	Kitchen Ventilation
CF2R-	PLB-01-E	Plumbing-DHW-NonHERS	Multifamily Central Hot Water System Distribution
CF2R-	PLB-02-E	Plumbing (DHW)-NonHERS	Single Dwelling Unit Hot Water System Distribution
CF2R-	PLB-03-E	Plumbing (DHW)-NonHERS	Pool and Spa Heating Systems
CF2R-	PLB-21-H	Plumbing (DHW)-HERS	HERS Verified Multifamily Central Hot Water System Distribution
CF2R-	PLB-22-H	Plumbing (DHW)-HERS	HERS Verified Single Dwelling Unit Hot Water System Distribution
CF2R-	PVB-01-E	Photovoltaics-NonHERS	Photovoltaic Systems
CF2R-	PVB-02-E	Photovoltaics-NonHERS	Battery Storage Systems
CF2R-	SRA-01-E	Solar Ready	Solar Ready Areas
CF2R-	SRA-02-E	Solar Ready	Minimum Solar Zone Area Worksheet
CF2R-	STH-01-E	Solar Thermal	Solar Water Heating Systems
CF3R's – Certificate of Verification~~I nstallation~~	X	X	X

Doc Type	Doc Category	Category Description	Document Description
CF3R-	ENV-20-H	Envelope-HERS	Building Leakage Diagnostic Test
CF3R-	ENV-21-H	Envelope-HERS	QII - Framing Stage
CF3R-	ENV-22-H	Envelope-HERS	QII – Insulation Installation Stage
CF3R-	EXC-20-H	Existing Conditions	HERS Verification of Existing Conditions for Residential Alterations
CF3R-	MCH-20-H	Mechanical-HERS	Duct Leakage Diagnostic Test
CF3R-	MCH-21-H	Mechanical-HERS	Duct Location Verification
CF3R-	MCH-22-H	Mechanical-HERS	Fan Efficacy
CF3R-	MCH-23-H	Mechanical-HERS	Airflow Rate
CF3R-	MCH-24-H	Envelope-HERS	Building Envelope Air Leakage Worksheet
CF3R-	MCH-25-H	Mechanical-HERS	Refrigerant Charge Verification
CF3R-	MCH-26-H	Mechanical-HERS	Rated Space Conditioning System Equipment Verification
CF3R-	MCH-27-H	Mechanical-HERS	Indoor Air Quality and Mechanical Ventilation
CF3R-	MCH-28-H	Mechanical-HERS	Return Duct Design and Air Filter Device Sizing According to Tables 150.0-B or C
CF3R-	MCH-29-H	Mechanical-HERS	Duct Surface Area Reduction; R-value; Buried Ducts Compliance Credit
CF3R-	MCH-31-H	Mechanical-HERS	HERS Verified Whole House Fan
CF3R-	MCH-31-H	Mechanical-HERS	Kitchen Ventilation
CF3R-	PLB-21-H	Plumbing (DHW)-HERS	HERS Verified Multifamily Central Hot Water System Distribution
CF3R-	PLB-22-H	Plumbing (DHW)-HERS	HERS Verified High Rise Residential/Hotel/Motel Single Dwelling Unit Hot Water System Distribution
NRCV-	MCH-04-H	Mechanical-HERS	Duct Leakage Diagnostic Test
NRCV-	MCH-24-H	Mechanical-HERS	Building Envelope Air Leakage Worksheet
NRCV-	MCH-27-H	Mechanical-HERS	Indoor Air Quality and Mechanical Ventilation

Doc Type	Doc Category	Category Description	Document Description
NRCV-	PLB-21-H	Plumbing (DHW)-HERS	HERS Verified Multifamily Central Hot Water System Distribution
NRCV-	PLB-22-H	Plumbing (DHW)-HERS	HERS Verified High Rise Residential/Hotel/Motel Single Dwelling Unit Hot Water System Distribution

Appendix D, p. 1

For Prescriptive Compliance: The attic shall be ventilated to:

(a) Provide a minimum free ventilation area of not less than one square foot of vent area for each 300 ft² of attic floor area.

(b) Provide no less than 30 percent upper vents.

(c) Ridge vents or gable end vents are recommended to achieve the best performance. The material should be cut to allow for full airflow to the venting.

(d) The product shall meet all requirements for California certified insulation materials [radiant barriers] of the, Bureau of Household Goods and Services (BHGS)~~Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation~~, as specified by CCR, Title 24, Part 12, Chapter 12-13, Standards for Insulating Material.

The use of a radiant barrier shall be listed in the Special Features and Modeling Assumptions listings of the Certificate of Compliance and described in detail in the Residential ACM Manual Conform to the radiant barrier manufacturer's instructions.