

2019 Energy Code

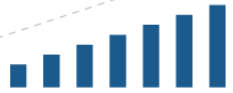
Residential Envelope Requirements



California Energy Commission
October 2020



PRIMARY FUNCTIONS OF THE CALIFORNIA ENERGY COMMISSION



**Advancing State
Energy Policy**



**Investing in
Energy Innovation**



**Developing
Renewable Energy**



**Preparing for
Energy Emergencies**



**Achieving
Energy Efficiency**



**Transforming
Transportation**



**Overseeing
Energy Infrastructure**



**Intergovernmental
Collaboration**



Agenda

- 2019 Energy Code Basics
- Navigating Title 24
- Fenestration and Exterior Doors
- Air Sealing
- Vapor Barrier
- Insulation and Radiant Barrier
- Roofing Materials
- Plan Check and Inspection
- Resources



2019 Energy Code Basics

Residential



Energy Code History

The Warren-Alquist Act established the California Energy Commission in 1974

- Authority to develop and maintain Building Energy Efficiency Standards (Energy Code)
- Requires the CEC to update periodically, usually every three years
- Requires the Energy Code to be cost effective over the economic life of the building

WARREN-ALQUIST ACT

Warren-Alquist
State Energy Resources
Conservation and
Development Act

Public Resources Code
Section 25000 et seq.



CALIFORNIA
ENERGY COMMISSION
Gavin Newsom, Governor

2020 EDITION
JANUARY 2020
CEC-140-2020-001



Low-Rise Residential

- Single family - any number of stories
- Duplexes - any number of stories
- Townhouses - no more than three habitable stories
- Multifamily - no more than three habitable stories





2019 Energy Savings

Low-rise residential

- 7% more efficient than 2016 Standards
- Energy consumption reduced by an average 53% with photovoltaic (PV)
- Monthly lifecycle cost is \$40 with savings of \$80 for typical home
- GHG emission reduction of 700k metric tons over 3 years





2019 Energy Code

Effective January 1, 2020

- All building permit applications submitted on or after effective date
- Must use 2019 software and forms





2019 Documents Online

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 **CALIFORNIA ENERGY COMMISSION**

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2019 Building Energy Efficiency Standards

The 2019 Building Energy Efficiency Standards improve upon the 2016 Energy Standards for new construction of, and additions and alterations to, residential and nonresidential buildings. Buildings permitted on or after January 1, 2020, must comply with the 2019 Standards. The California Energy Commission updates the standards every three years.

[Expand All](#)

[2019 Building Energy Efficiency Standards and Compliance Manuals](#) 

[2019 Compliance Forms](#) 

BUILDING ENERGY EFFICIENCY STANDARDS - TITLE 24

- 2022 Building Energy Efficiency Standards
- 2019 Building Energy Efficiency Standards**
- 2016 Building Energy Efficiency Standards
- Online Resource Center
- Past Building Energy Efficiency Standards

CONTACT

[Building Energy Efficiency Standards - Title 24](#)

Toll-free in California: 800-772-3300
Outside California: 916-654-5106

- Energy Code
- Reference Appendices
- Compliance Manuals
- Forms
 - [Energy Code Ace](#)



Energy Code Requirements

Mandatory measures

- Minimum efficiency requirements must always be met
- Can never trade off

Prescriptive measures

- Predefined efficiency requirements
- May supersede mandatory measures
- Different requirements for newly constructed buildings, additions, and alterations



Compliance Approaches

Prescriptive Approach

- Simple approach, no trade-offs
- Mostly used for alterations
- Standard building baseline

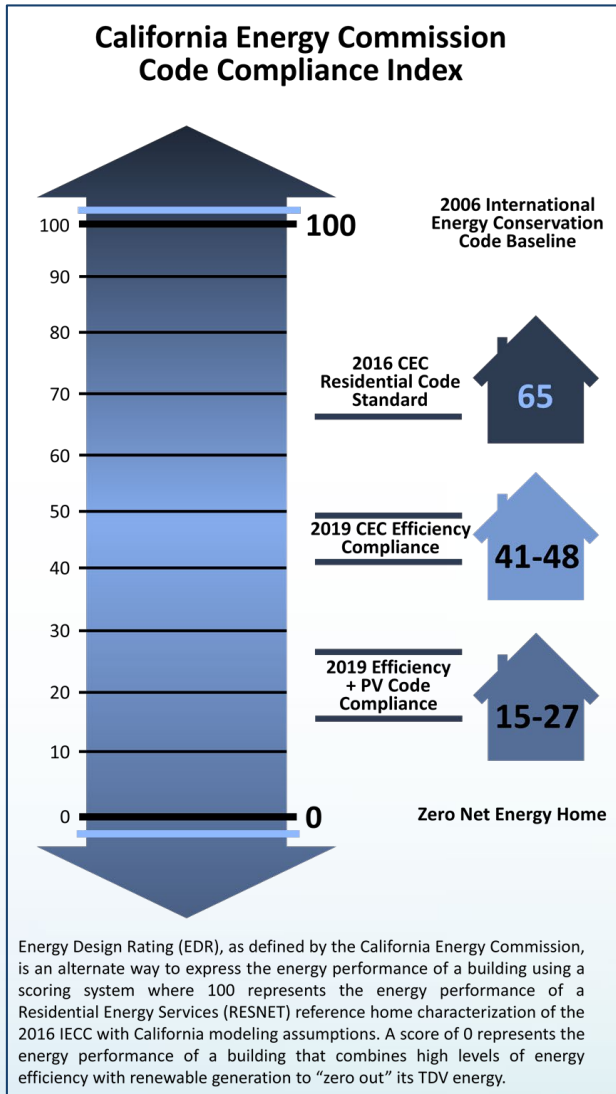
Performance Approach

- Most flexible approach, allows for trade-of
- Must meet all mandatory requirements
- Requires the use of CEC approved software
- Efficiency EDR proposed \leq standard efficiency EDR
- Total EDR (including PV) \leq standard total EDR
- Additions and alteration projects still use TDV





Energy Design Rating (EDR)



Low-rise residential EDR score based on total estimated energy use

- 100 represents a home built to 2006 IECC
- 0 represents a zero net energy home
- Two types of EDR must be met individually
 - **Efficiency EDR:** Includes energy savings for space heating, cooling, ventilation, and water heating measures
 - **Total EDR:** Includes efficiency EDR minus compliance credit for PV, battery, and other demand flexibility measures



2019 Compliance Software

Performance approach compliance use most recently approved versions

- Residential
 - CBECC-Res 2019.1.3
 - EnergyPro 8.1 Residential
 - Right-Energy 2019.1.1
- Nonresidential
 - CBECC-Com 2019.1.3
 - EnergyPro 8.1 Commercial

Calculation Date/Time: 2019-07-08T18:42:27-07:00		CF1R-PRF-01E
Input File Name: Sample T24 2019 CBECC.ribd19		(Page 1 of 12)
05	Standards Version	2019
07	Software Version	CBECC-Res 2019.1.0 (1079)



Demonstrating Compliance

Compliance forms confirm Energy Code is met

- Completed by designers, consultants, builders, contractors, technicians, HERS raters, etc.
- Submitted to enforcement agencies for verification
 - Certificate of Compliance
 - Certificate of Installation
 - Certificate of Acceptance
 - Certificate of Verification



Mandatory Measures Summary

Low-rise residential

- Designers may choose to include on plans
- Enforcement agencies may require on plans



2019 Low-Rise Residential Mandatory Measures Summary

NOTE: Low-rise residential buildings subject to the Energy Standards must comply with all applicable mandatory measures, regardless of the compliance approach used. Review the respective section for more information. *Exceptions may apply.
(Original 08/2019)

Building Envelope Measures:	
§ 110.6(a)1:	Air Leakage. Manufactured fenestration, exterior doors, and exterior pet doors must limit air leakage to 0.3 cfm per square foot or less when tested per NFRC-400, ASTM E283 or AAMA WDMA/CSA 1010.5/2A440-2011.
§ 110.6(a)5:	Labeling. Fenestration products and exterior doors must have a label meeting the requirements of Section 10-111(a).
§ 110.6(b):	Field fabricated exterior doors and fenestration products must use U-factors and solar heat gain coefficient (SHGC) values from Tables 110.6-A, 110.6-B, or 110.6-C for exterior doors. They must be caulked and/or weather stripped.
§ 110.7:	Air Leakage. All joints, penetrations, and other openings in the building envelope that are potential sources of air leakage must be caulked, gasketed, or weather stripped.
§ 110.8(a):	Insulation Certification by Manufacturers. Insulation must be certified by the Department of Consumer Affairs, Bureau of Household Goods and Services (BHGS).
§ 110.8(g):	Insulation Requirements for Heated Slab Floors. Heated slab floors must be insulated per the requirements of Section 110.8(g).
§ 110.8(i):	Roofing Products Solar Reflectance and Thermal Emittance. The thermal emittance and aged solar reflectance values of the roofing material must meet the requirements of § 110.8(i) and be labeled per § 10-113 when the installation of a cool roof is specified on the CP1R.
§ 110.8(j):	Radiant Barrier. When required, radiant barriers must have an emittance of 0.05 or less and be certified to the Department of Consumer Affairs.
§ 150.0(a):	Ceiling and Rafter Roof Insulation. Minimum R-22 insulation in wood-frame ceiling, or the weighted average U-factor must not exceed 0.043. Minimum R-19 or weighted average U-factor of 0.054 or less in a rafter roof alteration. Attic access doors must have permanently attached insulation using adhesive or mechanical fasteners. The attic access must be gasketed to prevent air leakage. Insulation must be installed in direct contact with a continuous roof or ceiling which is sealed to limit infiltration and exfiltration as specified in § 110.7, including but not limited to placing insulation either above or below the roof deck or on top of a drywall ceiling.
§ 150.0(b):	Loose-fill Insulation. Loose fill insulation must meet the manufacturer's required density for the labeled R-value.
§ 150.0(c):	Wall Insulation. Minimum R-13 insulation in 2x4 inch wood framing wall or have a U-factor of 0.102 or less, or R-20 in 2x6 inch wood framing or have a U-factor of 0.071 or less, (R-19 in 2x6 or U-factor of 0.074 or less). Opaque non-framed assemblies must have an overall assembly U-factor not exceeding 0.102, equivalent to an installed value of R-13 in a wood framed assembly. Masonry walls must meet Table 150.1-A or B.*
§ 150.0(d):	Raised-floor Insulation. Minimum R-19 insulation in raised wood framed floor or 0.037 maximum U-factor.*
§ 150.0(f):	Slab Edge Insulation. Slab edge insulation must meet all of the following: have a water absorption rate, for the insulation material alone without facings no greater than 0.3%; have a water vapor permeance no greater than 2.0 perm per inch; be protected from physical damage and UV light deterioration; and, when installed as part of a heated slab floor, meet the requirements of § 110.8(g).
§ 150.0(g)1:	Vapor Retarder. In climate zones 1 through 16, the earth floor or unvented crawl space must be covered with a Class I or Class II vapor retarder. This requirement also applies to controlled ventilation crawl space for buildings complying with the exception to § 150.0(d).
§ 150.0(g)2:	Vapor Retarder. In climate zones 14 and 16, a Class I or Class II vapor retarder must be installed on the conditioned space side of all insulation in all exterior walls, vented attics, and unvented attics with air permeable insulation.
§ 150.0(q):	Fenestration Products. Fenestration, including skylights, separating conditioned space from unconditioned space or outdoors must have a maximum U-factor of 0.58; or the weighted average U-factor of all fenestration must not exceed 0.58.*
Fireplaces, Decorative Gas Appliances, and Gas Log Measures:	
§ 110.5(e)	Pilot Light. Continuously burning pilot lights are not allowed for indoor and outdoor fireplaces.
§ 150.0(e)1:	Closable Doors. Masonry or factory-built fireplaces must have a closable metal or glass door covering the entire opening of the firebox.
§ 150.0(e)2:	Combustion Intake. Masonry or factory-built fireplaces must have a combustion outside air intake, which is at least six square inches in area and is equipped with a readily accessible, operable, and tight-fitting damper or combustion-air control device.*
§ 150.0(e)3:	Flue Damper. Masonry or factory-built fireplaces must have a flue damper with a readily accessible control.*
Space Conditioning, Water Heating, and Plumbing System Measures:	
§ 110.0-§ 110.3:	Certification. Heating, ventilation and air conditioning (HVAC) equipment, water heaters, showerheads, faucets, and all other regulated appliances must be certified by the manufacturer to the Energy Commission.*
§ 110.2(a):	HVAC Efficiency. Equipment must meet the applicable efficiency requirements in Table 110.2-A through Table 110.2-K.*
§ 110.2(b):	Controls for Heat Pumps with Supplementary Electric Resistance Heaters. Heat pumps with supplementary electric resistance heaters must have controls that prevent supplementary heater operation when the heating load can be met by the heat pump alone; and in which the cut-on temperature for compression heating is higher than the cut-on temperature for supplementary heating, and the cut-off temperature for compression heating is higher than the cut-off temperature for supplementary heating.*
§ 110.2(c):	Thermostats. All heating or cooling systems not controlled by a central energy management control system (EMCS) must have a setback thermostat.*
§ 110.3(c)4:	Water Heating Recirculation Loops Serving Multiple Dwelling Units. Water heating recirculation loops serving multiple dwelling units must meet the air release valve, backflow prevention, pump priming, pump isolation valve, and recirculation loop connection requirements of § 110.3(c)4.
§ 110.3(c)6:	Isolation Valves. Instantaneous water heaters with an input rating greater than 6.8 kBtu per hour (2 kW) must have isolation valves with hose bibbs or other fittings on both cold and hot water lines to allow for flushing the water heater when the valves are closed.
§ 110.5:	Pilot Lights. Continuously burning pilot lights are prohibited for natural gas: fan-type central furnaces; household cooking appliances (appliances without an electrical supply voltage connection with pilot lights that consume less than 150 Btu/hr are exempt); and pool and spa heaters.*
§ 150.0(h)1:	Building Cooling and Heating Loads. Heating and/or cooling loads are calculated in accordance with the ASHRAE Handbook, Equipment Volume, Applications Volume, and Fundamentals Volume; the SMACNA Residential Comfort System Installation Standards Manual; or the ACCA Manual J using design conditions specified in § 150.0(h)2.



Certificate of Compliance

Certificate of Compliance – CF1Rs

- Demonstrates compliance at design phase
- Completed by designer, architect, energy consultant, engineer, etc.
- Submit with permit application, include with plans
- Plans examiner verifies CF1R matches specs on plans

STATE OF CALIFORNIA
NEWLY CONSTRUCTED BUILDINGS
CF1R-NB-01-E (Revised 01/19)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE
Prescriptive Newly Constructed Buildings
Project Name: _____ Date Prepared: _____ (Page 1 of 9)

A. General Information

01: Project Name	02: Date Prepared
03: Project Location	04: Building Front Orientation (deg or cardinal)
05: CA City	06: Number of Dwelling Units
07: Zip Code	08: Fuel Type
09: Climate Zone	10: Total Conditioned Floor Area (ft ²)
11: Building Type	12: Slab Area (ft ²)
13: Project Scope	14: Exception to Fenestration U-factor & SHGC 150.1(c)(3)

B. Opaque Surface Detail – Framed Walls / Framed Floors / Concrete Raised Floors (Section 150.1(c)(1))

01	02	03	04	05	06	07	08	09	10	11	12
Tag ID	Assembly Type	Frame Type	Frame Depth (inches)	Frame Spacing (inches)	Cavity R-value	Proposed		Required		U-Factor from Table 150.1-A or B	Comments
						Continuous Insulation R-value	U-Factor	Appendix JA4 Reference Table	Cell		

C. Opaque Surface Detail – Nonframed (Section 150.1(c)(1))

01	02	03	04	05	06	07	08	09	10		
Tag ID	Assembly Materials	Thickness (inches)	Core Insulation R-value	Continuous Insulation R-value	U-Factor	Proposed		Required		U-Factor from Table 150.1-A or B	Comments
						Appendix JA4 Reference Table	Cell	Appendix JA4 Reference Table	Cell		

Registration Number: _____ Registration Date/Time: _____ HERS Provider: _____ January 2019



Certificate of Installation

STATE OF CALIFORNIA QII - INSULATION INSTALLATION CEC-CF2R-ENV-22-H (Revised 01/19)		CALIFORNIA ENERGY COMMISSION	
CERTIFICATE OF INSTALLATION		CF2R-ENV-22-H	
Quality Insulation Installation (QII) - Insulation Installation		(Page 1 of 4)	
Project Name:	Enforcement Agency:	Permit Number:	
Dwelling Address:	City:	Zip Code:	
A. Insulation Materials Installed			
01	Roof/Deck Insulation Material Installed		
02	Ceiling Insulation Material Installed		
03	Exterior Wall Insulation Material Installed		
04	Raised Floor Insulation Material Installed		
05	Slab Edge Insulation Material Installed		
B. All Surfaces			
01	Air barrier installation and preparation for insulation was done and verified prior to insulation being installed.		
02	All surfaces between conditioned and unconditioned space are sealed and insulated to meet or exceed the levels specified on the Certificate of Compliance.		
03	All structural framing areas shall be insulated in a manner that resists thermal bridging through the assembly separating conditioned from unconditioned space. Structural bracing, tie-downs, and framing of steel, or specialized framing used to meet structural requirements of the CBC are allowed and must be insulated. These areas shall be called out on the building plans with diagrams and/or specified design drawings indicating the R-value of insulation and fastening method to be used.		
04	All insulation was installed according to the manufacturer's installation instructions.		
05	Labels or specification/data sheets for each insulation material shall be provided to the HERS rater. Loose-fill material includes insulation material bag labels or coverage charts.		
06	Loose-fill insulation - The installed depth and density of insulation is verified in at least 6 random locations to ensure that the minimum thickness and installed density meet the R-value specified on the Certificate of Compliance, and are consistent with the manufacturer's coverage chart.		
07	If kraft paper faced insulation is used, paper is installed on the conditioned (warm in winter) side of surface. Paper must be in contact with air barrier to within 2" framing (stud, joists, etc.).		
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.			
C. Raised Floor Adjacent to Unconditioned Space			
01	Insulation is in full contact with the subfloor.		
02	Insulation hangers are spaced at 18 inches or less. Insulation hangers do not compress insulation.		
03	Netting, or mesh, can be used if the cavity under the floor is tiled and in contact with the subfloor.		
04	When daylight basements are adjacent to crawlspaces, if the basement is conditioned the walls adjacent to the crawlspace are insulated to the R-value listed on the Certificate of Compliance. This includes framed stem walls, and vertical concrete retaining walls.		
05	If access to the crawlspace is from the conditioned area the raised floor includes an airtight insulated access hatch. Where possible locate crawlspace access on the exterior.		
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.			
D. Wall Adjacent to Unconditioned Space			
01	Insulation quality was verified prior to the installation of the interior air barrier (typically gypsum board).		
02	Loose-fill and batt insulation is in contact with all six sides of wall cavities (top, bottom, back, left, right, front [to be installed later]) with no gaps, voids or compression. Exception: Where framing depth is greater than minimum required insulation thickness (e.g., R-19 batts in 2x10 walls).		
03	Insulation fits snugly around obstructions (e.g., electrical boxes, plumbing and wiring) with no gaps, voids or compression.		
04	Structural metal tie-downs and shear panels are insulated between exterior air barrier and metal.		
05	Hard to access wall stud cavities, such as corner channels or wall intersections, are insulated to the proper R-value prior to the installation of exterior sheathing or exterior stucco lath.		
06	Insulation and interior air barrier are installed behind tub, shower, fireplace enclosures and stairwells to the R-value listed on the Certificate of Compliance when located against exterior walls.		
07	All single-member window and door headers shall be insulated to a minimum of R-3 for a 2x4 framing, or equivalent width, and a minimum of R-5 for all other assemblies. If continuous exterior rigid insulation equal to or greater than R-2 is used, an insulated header is not required.		
08	After insulation is installed: All insulated walls have interior and exterior air barriers, including kneewalls and walls of skylight wells. Exception: Rim joists. Interior air barrier (typically gypsum board) is sealed to top plate.		
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.			
Registration Number: _____ Registration Date/Time: _____ HERS Provider: _____			
CA Building Energy Efficiency Standards - 2019 Residential Compliance January 2019			

Certificate of Installation – CF2Rs

- Completed by builder, installing contractor, or HERS rater
- Confirms compliance at installation
- Identifies energy efficiency measures installed per the CF1R and mandatory measures
- Left on-site for building inspector
- Inspector verifies documented efficiency and components match installed equipment and systems



Certificate of Verification

STATE OF CALIFORNIA QII - INSULATION INSTALLATION CEC-CF3R-ENV-22-H (Revised 01/19)		CALIFORNIA ENERGY COMMISSION	
CERTIFICATE OF VERIFICATION		CF3R-ENV-22-H	
Quality Insulation Installation (QII) - Insulation Installation		(Page 1 of 6)	
Project Name:	Enforcement Agency:	Permit Number:	
Dwelling Address:	City:	Zip Code:	
A. Insulation Materials Installed			
01	Roof Deck Insulation Material Installed		
02	Ceiling Insulation Material Installed		
03	Exterior Wall Insulation Material Installed		
04	Raised Floor Insulation Material Installed		
05	Slab Edge Insulation Material Installed		
06	Verification Status		
07	Correction Notes		
B. All Surfaces			
01	Air barrier installation and preparation for insulation was done and verified prior to insulation being installed.		
02	All surfaces between conditioned and unconditioned space are sealed and insulated to meet or exceed the levels specified on the Certificate of Compliance.		
03	All structural framing areas shall be insulated in a manner that resists thermal bridging through the assembly separating conditioned from unconditioned space. Structural bracing, tie-downs, and framing of steel, or specialized framing used to meet structural requirements of the CBC are allowed and must be insulated. These areas shall be called out on the building plans with diagrams and/or specified design drawings indicating the R-value of insulation and fastening method to be used.		
04	All insulation was installed according to the manufacturer's installation instructions.		
05	Labels or specification/data sheets for each insulation material shall be provided to the HERS rater. Loose-fill material includes insulation material bag labels or coverage charts.		
06	Loose-fill insulation - The installed depth and density of insulation is verified in at least 6 random locations to ensure that the minimum thickness and installed density meet the R-value specified on the Certificate of Compliance, and are consistent with the manufacturer's coverage chart.		
07	If kraft paper faced insulation is used, paper is installed on the conditioned (warm in winter) side of surface. Paper must be in contact with air barrier to within 2" framing (stud, joist, etc.).		
08	Verification Status	<input type="checkbox"/> Pass - all applicable requirements are met or <input type="checkbox"/> Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below or <input type="checkbox"/> All N/A - This entire table is not applicable.	
09	Correction Notes		
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Correction Notes.			
C. Raised Floor Adjacent to Unconditioned Space			
01	Insulation is in full contact with the subfloor.		
02	Insulation hangers are spaced at 19 inches or less. Insulation hangers do not compress insulation.		
03	Netting, or mesh, can be used if the cavity under the floor is filled and in contact with the subfloor.		
04	When daylight basements are adjacent to crawlspaces, if the basement is conditioned the walls adjacent to the crawlspace are insulated to the R-value listed on the Certificate of Compliance. This includes framed stem walls, and vertical concrete retaining walls.		
05	If access to the crawlspace is from the conditioned area the raised floor includes an airtight insulated access hatch. Where possible locate crawl space access on the exterior.		
06	Verification Status	<input type="checkbox"/> Pass - all applicable requirements are met or <input type="checkbox"/> Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below or <input type="checkbox"/> All N/A - This entire table is not applicable.	
07	Correction Notes		
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Correction Notes.			
Registration Number: _____ Registration Date/Time: _____ HERS Provider: _____			
CA Building Energy Efficiency Standards - 2019 Residential Compliance January 2019			

Certificate of Verification – CF3Rs

- Completed by HERS rater
- Registered with approved HERS provider
- Confirms compliance with HERS testing requirements
 - Air sealing
 - Insulation installation
 - Duct leakage
 - Airflow
 - Refrigeration charge
- Required for final inspection
- Inspector verifies tests and forms are complete, signed, and registered



Alterations and Additions

CF1Rs and CF2Rs

- Non-HERS projects
- Dynamic
- Interactive instructions
- Scope specific

STATE OF CALIFORNIA Prescriptive Residential Alterations That Do Not Require HERS Field Verification CEC-CF1R-ALT-05-E (Revised 01/20)		CALIFORNIA ENERGY COMMISSION CF1R-ALT-05-E	
CERTIFICATE OF COMPLIANCE		Page 1 of 2	
Prescriptive Residential Alterations That Do Not Require HERS Field Verification		Date Prepared:	
Project Name:		Date Prepared:	
<p>This compliance document is only applicable to simple alterations that do not require HERS verification for compliance. When HERS verification is required, a CF1R-ALT-01 shall first be registered with a HERS Provider Data Registry.</p> <p>Alterations to Space Conditioning Systems that are exempt from HERS verification requirements may use the CF1R-ALT-05 and CF2R-ALT-05 Compliance Documents. Possible exemptions from duct leakage testing include: less than 40 ft of ducts were added or replaced; or the existing duct system was insulated with asbestos; or the existing duct system was previously tested and passed by a HERS Rater. If space conditioning systems are altered and are not exempt from HERS verification, then a CF1R-ALT-02 must be completed and registered with a HERS Provider Data Registry.</p> <p>Alterations that utilize close Cell Spray Polyurethane Foam (ccSPF) with a density of 1.5 to less than 2.5 pounds per cubic foot having an R-value greater than 5.8 per inch, or Open Cell Spray Polyurethane Foam (ocSPF) with a density of 0.4 to less than 1.5 pounds per cubic foot having an R-value of 3.6 per inch, shall complete and register a CF1R-ALT-01 with a HERS Provider Data Registry.</p> <p>If more than one person has responsibility for installation of the items on this certificate, each person shall prepare and sign a certificate applicable to the portion of construction for which they are responsible. Alternatively, the person with chief responsibility for construction shall prepare and sign this certificate for the entire construction. All applicable Mandatory Measures shall be met. Temporary labels shall not be removed before verification by the building inspector.</p>			
A. General Information			
01	Project Name:	02	Date Prepared:
03	Project Location:	04	Building Front Orientation (deg or cardinal):
05	CA City:		
07	Zip Code:		
09	Climate Zone:		
11	Building Type:		
13 Project Scope (Select all that apply):			
<input type="checkbox"/> B. Insulation <input type="checkbox"/> D. & E. Fenestration/Glazing - AD			
<input type="checkbox"/> C. Roof Replacement <input type="checkbox"/> D. & F. Fenestration/G			
CA Building Energy Efficiency Standards - 2019 Residential Compliance			

STATE OF CALIFORNIA Prescriptive Residential Additions That Do Not Require HERS Field Verification CEC-CF1R-ADD-02-E (Revised 01/20)		CALIFORNIA ENERGY COMMISSION CF1R-ADD-02-E	
CERTIFICATE OF COMPLIANCE		Page 1 of 2	
Prescriptive Residential Additions That Do Not Require HERS Field Verification		Date Prepared:	
Project Name:		Date Prepared:	
<p>This compliance document is only applicable to additions less than or equal to 1,000 ft² and do not require HERS field verification for compliance. When HERS verification is required, a CF1R-ADD-01 shall first be registered with a HERS Provider Data Registry.</p> <p>Alterations to Space Conditioning Systems that are exempt from HERS verification requirements may use the CF1R-ADD-02 and CF2R-ADD-02 Compliance Documents. Possible exemptions from duct leakage testing include: less than 40 ft of ducts were added or replaced; or the existing duct system was insulated with asbestos; or the existing duct system was previously tested and passed by a HERS Rater. If space conditioning systems are altered and are not exempt from HERS verification, then a CF1R-ADD-01 and a CF1R-ALT-02 must be completed and registered with a HERS Provider Data Registry.</p> <p>Additions or alterations that utilize close Cell Spray Polyurethane Foam (ccSPF) with a density of 1.5 to less than 2.5 pounds per cubic foot having an R-value greater than 5.8 per inch, or Open Cell Spray Polyurethane Foam (ocSPF) with a density of 0.4 to less than 1.5 pounds per cubic foot having an R-value of 3.6 per inch, shall complete and register a CF1R-ADD-01 with a HERS Provider Data Registry.</p> <p>If more than one person has responsibility for installation of the items on this certificate, each person shall prepare and sign a certificate applicable to the portion of construction for which they are responsible. Alternatively, the person with chief responsibility for construction shall prepare and sign this certificate for the entire construction. All applicable Mandatory Measures shall be met. Temporary labels shall not be removed before verification by the building inspector.</p>			
A. General Information (please complete entire table)			
01	Project Name:	02	Date Prepared:
03	Project Location:	04	Building Front Orientation (deg):
05	CA City:	06	Number of Dwelling Units with Additions:
07	Zip Code:	08	Fuel Type:
09	Climate Zone:	10	Total Conditioned Floor Area (ft ²) (Addition):
11	Building Type:	12	Slab Area (ft ²):
13	Project Scope:	14	Exceptions to Fenestration U-factor and SHGC 150.0 (ft ²):
14	Addition Wall Type:	<input type="checkbox"/> Framed <input type="checkbox"/> Non-framed <input type="checkbox"/> Mass Walls <input type="checkbox"/> None	
15	Roof Type:	<input type="checkbox"/> Steep slope <input type="checkbox"/> Low slope <input type="checkbox"/> None	
16	Roof/Ceiling insulation:	<input type="checkbox"/> Option B - Below deck insulation <input type="checkbox"/> Option C - Ducts & Air handler in conditioned space	
17	Windows being installed?	18	Door(s) being installed?
19	New water heater being installed?		
20	Are lighting requirements applicable?		
Note: Include mandatory measures? <input type="checkbox"/> Yes <input type="checkbox"/> No			
CA Building Energy Efficiency Standards - 2019 Residential Compliance			



Alterations and Additions

Forms Exception §10-103

Low-rise residential non-HERS alterations, and additions under 300 square feet

- CF1R and CF2R not required - at building departments discretion
- Exempts forms only
- May create simplified forms
- Include requirements on permit application
- Project must comply with Energy Code



Project Status Report

Project Status Report		CalCERTS, Inc	
		1 of 2	
GENERAL INFORMATION			
Code Year Standards:	2013	 Easy to Verify @ calcerts.com	
Project Name:	Shewmaker Performance Demo		
Project Type:	New Construction SFR		
Address:	1516 9th Street		
City / State / Zip:	Sacramento / CA / 95814		
Enforcement Agency:	City of Sacramento		
Permit Number:	123456789		
HERS VERIFIABLE MEASURES:		NOT COMPLETE	
OVERALL STATUS:		NOT COMPLETE	
CF1R INFORMATION - Certificate of Compliance ✓			
Certificate Type:		Compliance	
Registered Form:		CF1R-PRF-01-E	
Registered Date:		04/05/2016 08:30	
Registration Number:		216-N0125429A-000000000-0000	
ADDITIONAL CF1Rs			
System	Form	Registered Date	Registration Number
	CF1R-SRA-01		216-N012543A-000000000-0000
CF2R INFORMATION - Certificate of Installation			
System	Form	Registered Date	Registration Number
	CF2R-ENV-01 (Penetration Installation)		216-N0125429A-E0100001A-0000
	CF2R-ENV-02 (Envelope Air Sealing)		216-N0125429A-E0200001A-0000
	CF2R-ENV-03 (Insulation Installation)		216-N0125429A-E0300001A-0000
	CF2R-ENV-04 (Roofing-Radiant Barrier)		216-N0125429A-E0400001A-0000
	CF2R-MCH-01 (Space Conditioning Systems, Ducts and Fans)	04/05/2016 09:40	216-N0125429A-M0100001A-0000
System 1	CF2R-MCH-20 (Duct Leakage)	04/05/2016 09:40	216-N0125429A-M2000002A-0000
System 1	CF2R-MCH-23 (Airflow)	04/05/2016 09:40	216-N0125429A-M2300002A-0000
System 1	CF2R-MCH-22 (Fan Efficacy)	04/05/2016 09:40	216-N0125429A-M2200002A-0000
System 1	CF2R-MCH-25 (Refrigerant Charge)	04/05/2016 09:40	216-N0125429A-M2500002A-0000
	CF2R-MCH-27 (IAQ and MV)	04/05/2016 09:40	216-N0125429A-M2700001A-0000
	CF2R-PLB-02 (SD HWS Distribution)	04/05/2016 09:40	216-N0125429A-P0200003A-0000
CF3R INFORMATION - Certificate of Verification			
System	Form	Registered Date	Registration Number
	CF3R-MCH-27 (IAQ and MV)		216-N0125429A-M2700001A-M27A
System 1	CF3R-MCH-20 (Duct Leakage)	04/11/2016 12:52	216-N0125429A-M2000002A-M20A

CA Building Energy Efficiency Standards 2013 Residential Compliance HERS Provider: CalCERTS, Inc. Dec 2015

- Summarizes status of all required forms
- Available for any project in HERS registry
- Access directly in registry
- Request hard copy at final inspection to verify compliance
- HERS and Overall Status marked **Complete** to pass inspection
- May accept completed PSR in place of CF2R hard copies



2019 Energy Code

Residential Envelope

Navigating Title 24



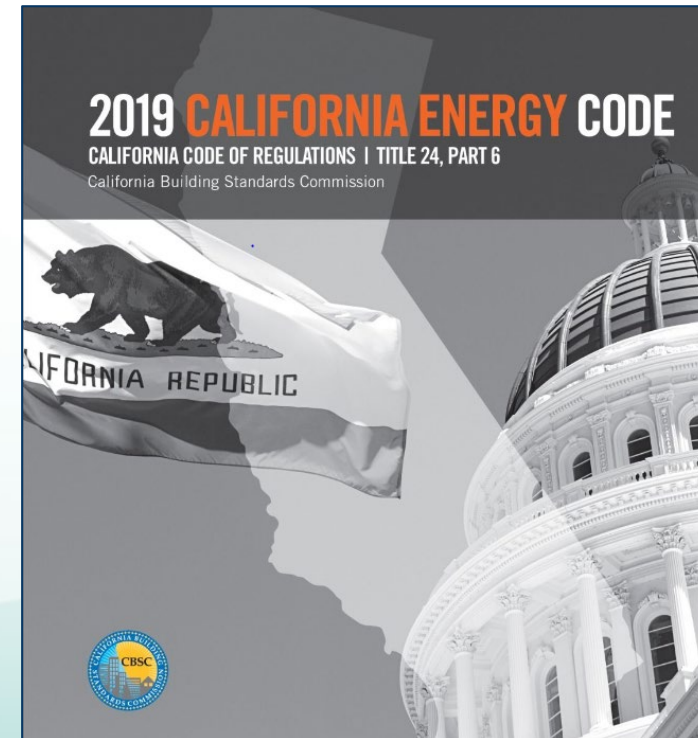
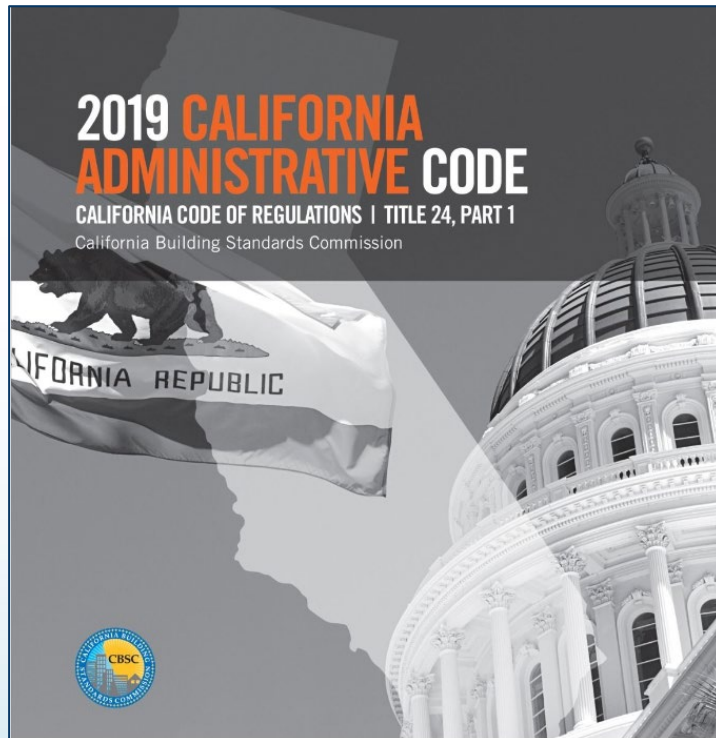
Title 24 – California Building Code

Part 1 - Administrative Code

- Chapter 10
- Sections 10-101 – 10-115
- Administrative requirements

Part 6 - Energy Code

- Subchapters 1 - 9
- Sections 100.0 - 150.2
- Technical requirements





Part 1 Administrative Code

All Buildings §§ 10-101 to 10-115

Regulations, definitions, permitting, compliance, enforcement, acceptance testing providers, local ordinances, interpretations, certification, labeling for fenestration and roofs, outdoor lighting zones, community shared solar, and battery storage

Relevant sections

§ 10-111 – Fenestration and door labels

§ 10-112 – Default tables

§ 10-113 – Roofing products



Part 6 Energy Code

All Buildings § 100.0 - Table 100.0-A

General Provisions for All Buildings		100.0, 100.1, 100.2, 110.0			
Occupancies	Application	Mandatory	Prescriptive	Performance	Additions/Alterations
General Provisions for All Buildings					
Low-Rise Residential	General	150.0	Envelope (conditioned)	110.6, 110.7, 110.8, 150(a), 150.0(b), 150.0(c), 150.0(d), 150.0(e), 150.0(g), 150.0(q)	
	Envelope (conditioned)	110.6, 110.7, 110.8, 150(a), 150.0(b), 150.0(c), 150.0(d), 150.0(e), 150.0(g), 150.0(q)			
	HVAC (conditioned)	110.2, 110.5, 150.0(h), 150.0(i), 150.0(j), 150.0(m), 150.0(o)			
	Water Heating	110.3, 150.0(j, n)	150.1(a, c)	150.1(a), 150.1(b)	150.2(a), 150.2(b)
	Indoor Lighting (conditioned, unconditioned and parking garages)	110.9, 130.0, 150.0(k)			
	Outdoor Lighting	110.9, 130.0, 150.0(k)			
	Pool and Spa Systems	110.4, 150.0(p)	N. A.	N.A.	150.2(a), 150.2(b)
	Solar Ready Buildings	110.10	N. A.	N.A.	N.A.

Residential relevant sections

§§ 110.6 - 110.8 All buildings

§ 150.0 Mandatory measures

§ 150.1 Prescriptive requirements

§ 150.2 Additions and alterations



Mandatory Requirements

All Buildings §§ 110.0 to 110.12

Regulates the manufacture and installation of components and systems for all buildings

Relevant sections

§ 110.6 – Fenestration and exterior doors

§ 110.7 – Air sealing

§ 110.8 – Insulation and roofing



Mandatory Requirements

Residential § 150.0

Covers requirements for design and installation of building envelopes, ventilation, space conditioning, water systems and lighting

Relevant sections

§ 150.0(a-d, f) - Insulation

§ 150.0(g) - Vapor Retarder

§ 150.0(q) - Fenestration



Performance and Prescriptive Requirements

Residential § 150.1

Performance and prescriptive compliance approaches

Relevant sections

§ 150.1(b) – Performance

§ 150.1(c) – Prescriptive

Table 150.1-A – Single Family Buildings

Table 150.1-B – Multifamily Buildings



Performance and Prescriptive Requirements

Additions and Alterations § 150.2

Performance and prescriptive compliance approaches

Relevant sections

§ 150.2(a) – Additions

§ 150.2(b) – Alterations



Envelope Defined

The building envelope is the exterior components, including demising partitions, which enclose conditioned space, separating it from unconditioned space or outside space.





Fenestration and Exterior Doors

Residential

Administrative §§ 10-111, 10-112

Mandatory §§ 100.1, 110.6, 150.0(q)

Prescriptive § 150.1(c)3, 5

Additions and Alterations §§ 150.2(a)1, 150.2(b)1



Fenestration Definitions

Fenestration - a transparent or translucent material plus any sash, frame, mullions, and dividers

U-factor - a measure of the heat transmission through the fenestration

Solar Heat Gain Coefficient (SHGC) - the fraction of solar radiation entering the space through the fenestration which is released as heat into the space

Lower U-factor and SHGC are more efficient



Fenestration Definitions



Three types of fenestration

- **Manufactured:** pre-assembled glazing and frame
 - Commonly used in residential
- **Site-Built:** plant-fabricated and field-assembled
 - Storefront or curtain wall system
 - Referred to as knock-down
- **Field-Fabricated:** field-made
 - Custom made at site for a specific application



Fenestration and Exterior Doors Administrative Regulations

All Buildings §§ 10-111, 10-112

Labeling and Certification Requirements § 10-111

- National Fenestration Rating Council (NFRC) is designated to administer certification program
- Temporary labels
 - NFRC manufactured window and door labels
 - Energy Commission default table values
- Label certificates
 - NFRC Component Modeling Approach (CMA)
 - NA6 Alternate Default Fenestration Procedure (NRCC-ENV-05)
- Permanent labels

Default Tables § 10-112

- Energy Commission calculates, maintains, and revises



Fenestration Temporary Labels

NFRC

 National Fenestration Rating Council® CERTIFIED	World's Best Window Co. Millennium 2000+ Vinyl-Clad Wood Frame Double Glazing • Argon Fill • Low E Product Type: Vertical Slider
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P) 0.30	Solar Heat Gain Coefficient 0.30
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance 0.51	Air Leakage (U.S./I-P) 0.2
<small>Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org</small>	

CEC

2019 California Energy Commission Default Label XYZ Manufacturing Co.		
Key Features:	<input type="checkbox"/> Doors	<input type="checkbox"/> Double-Pane
	<input type="checkbox"/> Skylight	<input type="checkbox"/> Glass Block
Frame Type	Product Type:	Product Glazing Type:
<input type="checkbox"/> Metal	<input type="checkbox"/> Operable	<input type="checkbox"/> Clear
<input type="checkbox"/> Non-Metal	<input type="checkbox"/> Fixed	<input type="checkbox"/> Tinted
<input type="checkbox"/> Metal, Thermal Break	<input type="checkbox"/> Greenhouse/Garden Window	<input type="checkbox"/> Single-Pane
<input type="checkbox"/> Air space 7/16 in. or greater <input type="checkbox"/> With built-in curb <input type="checkbox"/> Meets Thermal-Break Default Criteria	-----	To calculate VT see NA6
California Energy Commission Default U-factor =	California Energy Commission Default SHGC =	California Energy Commission Calculated VT =
Product meets the air infiltration requirements of §110.6(a)1, U-factor criteria of §110.6(a)2, SHGC criteria of §110.6(a)3 and VT criteria of §110.6(a)4 of the 2019 Energy Standards for Residential and Nonresidential Buildings.		



Fenestration and Exterior Door Mandatory Requirements

All Buildings §§ 100.1, 110.6

Exterior doors require U-factor rating

- NFRC
- Doors with 25% or more glazing treated as fenestration

Updated definitions

- *Fenestration Product*
- *Clerestory*
- *Door*
- *Glazed Door*
- *Overhang Projection*
- *Overhang Rise*

National Fenestration
Rating Council®

CERTIFIED

World's Best Door Co.

Entrance Door
CPD#000-x-000

Insulated Steel Wood Edge Door

ENERGY PERFORMANCE RATINGS

Product Description* Default Frame** Wood	U-Factor/Solar Heat Gain Coefficient (SHGC)			
	1/4 Lite <410†	1/2 Lite <900†	3/4 Lite <1100†	Full Lite >1100†
2:1A1haAIR0.250	0.23 —	0.30 —	0.36 0.33	0.40 0.40
2:1A1/.020(3)ARG0.750	0.21 —	0.24 —	0.26 0.31	0.28 0.36
2:1A1haAIR0.675	0.23 —	0.28 —	0.33 0.34	0.34 0.40
3:55haAIR0.250	0.21 —	0.25 —	0.27 0.35	0.29 0.40
Flush/Embossed	U-Factor 0.19 SHGC 0.04			

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.

* #glazing layers / spacer type / low-e emissivity (surface) / gap fill / gap width (na=not applicable)

** per NFRC 100 Section B3.24 † square inches

www.nfrc.org



Fenestration and Exterior Door Mandatory Requirements

All Buildings § 110.6

Manufactured and site-built

- Certified by NFRC to meet requirements for air leakage, U-factor, and SHGC

Site-built

- Reference Nonresidential Appendix NA6 alternate default fenestration procedure
 - Residential - less than 250 square feet
 - Nonresidential - less than 200 square feet
- Meet acceptance requirements in Reference Nonresidential Appendix NA7

Field-fabricated

- Must use U-factor in Table 110.6-A and SHGC in Table 110.6-B
- Exterior doors less than 25% glazing use U-factor in Reference Joint Appendix JA4.5 Table 4.5.1
- Must be caulked and weather-stripped



Fenestration and Exterior Door Mandatory Requirements

All Buildings § 110.6

Methods for determining U-factor and SHGC

	Manufactured Windows	Manufactured Skylights	Manufactured Doors	Site-Built Fenestration and Doors	Field- Fabricated Fenestration and Doors	Glass Block
NFRC	✓	✓	✓	✓	n/a	n/a
NFRC - CMA	✓	✓	✓	✓	n/a	n/a
Default Table 110.6-A, B	✓	✓	n/a	✓	✓	✓
Default Table JA 4.5.1	n/a	n/a	✓	✓	✓	n/a
NA6 - less than 250 ft ²	n/a	n/a	n/a	✓	n/a	n/a



Fenestration Default U-factor

All Buildings Table 110.6-A

FRAME	PRODUCT TYPE	SINGLE PANE U-FACTOR	DOUBLE PANE U-FACTOR	GLASS BLOCK U-FACTOR
Metal	Operable	1.28	0.79	0.87
	Fixed	1.19	0.71	0.72
	Greenhouse or garden window	2.26	1.40	N.A.
	Glazed doors	1.25	0.77	N.A.
	Skylight	1.98	1.30	N.A.
Metal, thermal break	Operable	N.A.	0.66	N.A.
	Fixed	N.A.	0.55	N.A.
	Greenhouse or garden window	N.A.	1.12	N.A.
	Glazed Doors	N.A.	0.59	N.A.
	Skylight	N.A.	1.11	N.A.
Nonmetal	Operable	0.99	0.58	0.60
	Fixed	1.04	0.55	0.57
	Glazed Doors	0.99	0.53	N.A.
	Greenhouse or garden window	1.94	1.06	N.A.
	Skylight	1.47	0.84	N.A.



Fenestration Default SHGC

All Buildings Table 110.6-B

FRAME TYPE	PRODUCT	GLAZING	FENESTRATION PRODUCT SHGC		
			Single Pane SHGC	Double Pane SHGC	Glass Block SHGC
Metal	Operable	Clear	0.80	0.70	0.70
	Fixed	Clear	0.83	0.73	0.73
	Operable	Tinted	0.67	0.59	N.A.
	Fixed	Tinted	0.68	0.60	N.A.
Metal, thermal break	Operable	Clear	N.A.	0.63	N.A.
	Fixed	Clear	N.A.	0.69	N.A.
	Operable	Tinted	N.A.	0.53	N.A.
	Fixed	Tinted	N.A.	0.57	N.A.
Nonmetal	Operable	Clear	0.74	0.65	0.70
	Fixed	Clear	0.76	0.67	0.67
	Operable	Tinted	0.60	0.53	N.A.
	Fixed	Tinted	0.63	0.55	N.A.



Exterior Doors Default U-factor

All Buildings Reference Joint Appendix JA4.5

Table 4.5.1 – Doors

Description	U-factor	
	A	
Uninsulated single-layer metal <i>swinging doors</i> or <i>non-swinging doors</i> , including single-layer uninsulated access hatches and uninsulated smoke vents:	1	1.45
Uninsulated double-layer metal <i>swinging doors</i> or <i>non-swinging doors</i> , including double-layer uninsulated access hatches and uninsulated smoke vents:	2	0.70
Insulated metal <i>swinging doors</i> , including fire-rated <i>doors</i> , insulated access hatches, and insulated smoke vents:	3	0.50
Wood <i>doors</i> , minimum nominal thickness of 1-3/4 in. (44 mm), including panel <i>doors</i> with minimum panel thickness of 1-1/8 in. (28 mm), and solid core flush <i>doors</i> , and hollow core flush <i>doors</i> :	4	0.50
Any other wood <i>door</i> :	5	0.60
Uninsulated single layer metal <i>roll up doors</i> including fire rated <i>door</i>	6	1.45
Insulated single layer metal <i>sectional doors</i> , minimum insulation nominal thickness of 1-3/8 inch; expanded polystyrene (R-4 per inch).	7	0.179
Source: ASHRAE 90.1-2007, Section A7.		



Fenestration Mandatory Requirements

Residential § 150.0(q)

Windows, skylights and glazed doors

- U-factor of 0.58 or less
 - Exceptions to U-factor requirement:
 - Fenestration area up to 10 square feet or 5% of conditioned floor area (CFA)
 - Greenhouse or garden windows up to 30 square feet of fenestration area
- Weighted average of all fenestration not to exceed 0.58 U-factor





Fenestration Prescriptive Requirements

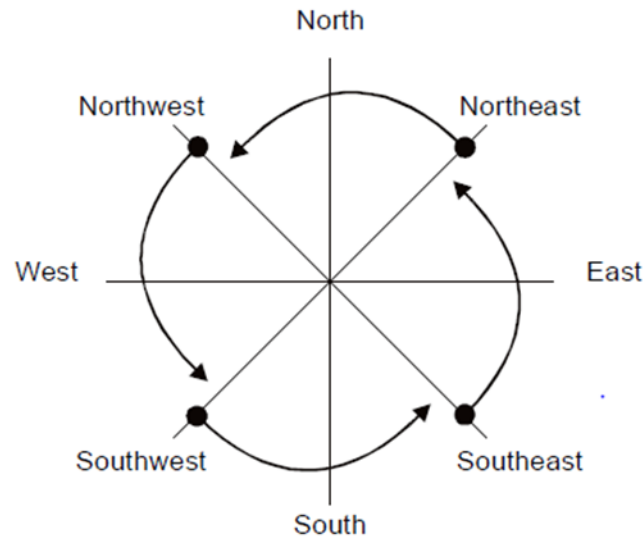
Residential § 150.1(c)3

Windows, skylights and glazed doors

Per Table 150.1-A or Table 150.1-B

- Maximum U-factor of 0.30
- Maximum SHGC of 0.23
 - No SHGC requirement in climate zones 1, 3, 5, 16
- Total fenestration area 20% maximum
- West-facing fenestration area 5% maximum in climate zones 2, 4, 6-16

Figure 3-13: Four Surface Orientations





Exterior Door Prescriptive Requirements

Residential § 150.1(c)5

Doors separating conditioned from unconditioned space

- Less than 25% glazed
- Must be NFRC rated and labeled
- Exception for fire protection doors between house and garage
- Per Table 150.1-A or Table 150.1-B
 - Maximum U-factor of 0.20





Residential Table 150.1-A and Table 150.1-B

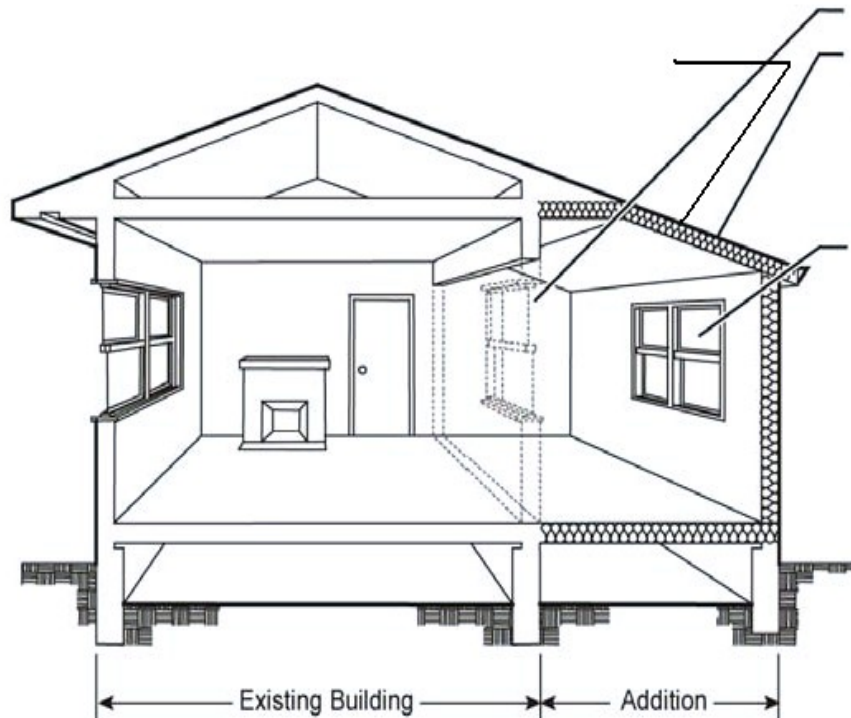
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Fenestration Prescriptive Requirements

Additions § 150.2(a)1

New windows, skylights, and glazed doors meet § 150.1(c) with modifications



Addition Square Feet	Maximum Total Area Square Feet	Maximum West-Facing Area Square Feet Climate Zones 2, 4, 6-16
Over 700	175 or 20% CFA	70
401 to 700	120 or 25% CFA	60
400 or less	75 or 30% CFA	60



Fenestration Prescriptive Requirements

Alterations § 150.2(b)1A

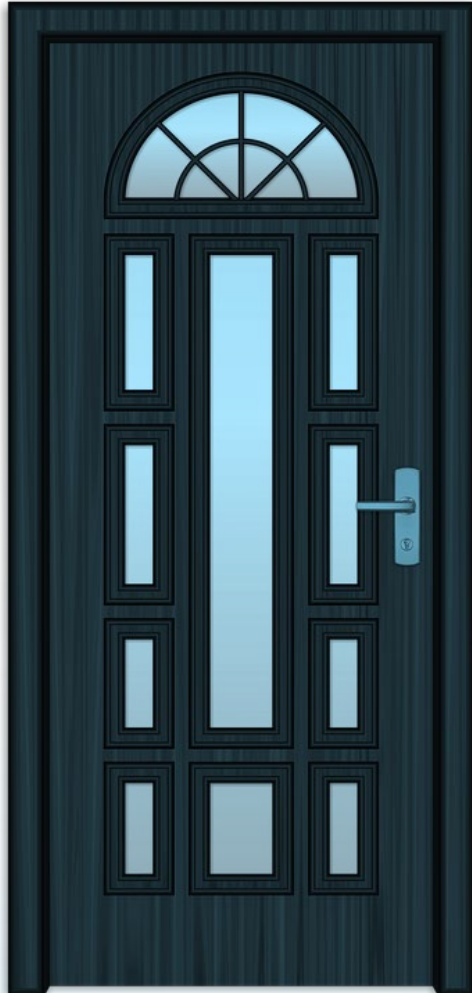
New windows, skylights, and glazed doors meet § 150.1(c) with modifications

	Square Feet Exempt from Area Requirements	Maximum U-Factor	Maximum SHGC Climate Zones 2, 4, 6-15
Additional Fenestration	Up to 75	0.30	0.23
Replacement Fenestration	Up to 75	0.40	0.35
Additional or Replacement Skylights	Up to 16	0.55	0.30





Test Your Knowledge



When does an exterior door become fenestration?

When the door has 25% or more glass

- Now considered part of the total fenestration area
- Glass area meets all fenestration requirements
- Solid area meets exterior door requirements



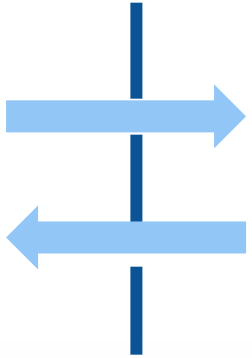
Air Sealing

All Buildings

Mandatory § 110.7

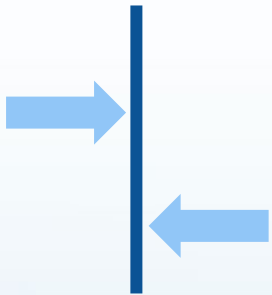


Air Sealing Definitions



Infiltration - uncontrolled air leakage from outside to inside, through cracks, joints, windows, doors, partitions, or penetrations

Exfiltration - uncontrolled air leakage from inside to outside, through cracks, joints, windows, doors, partitions, or penetrations



Air Barrier – a system of materials joined and sealed together to control air flow through the building envelope that separates conditioned from unconditioned space, or that separates adjoining conditioned spaces of different occupancies or uses



Air Sealing Mandatory Requirements

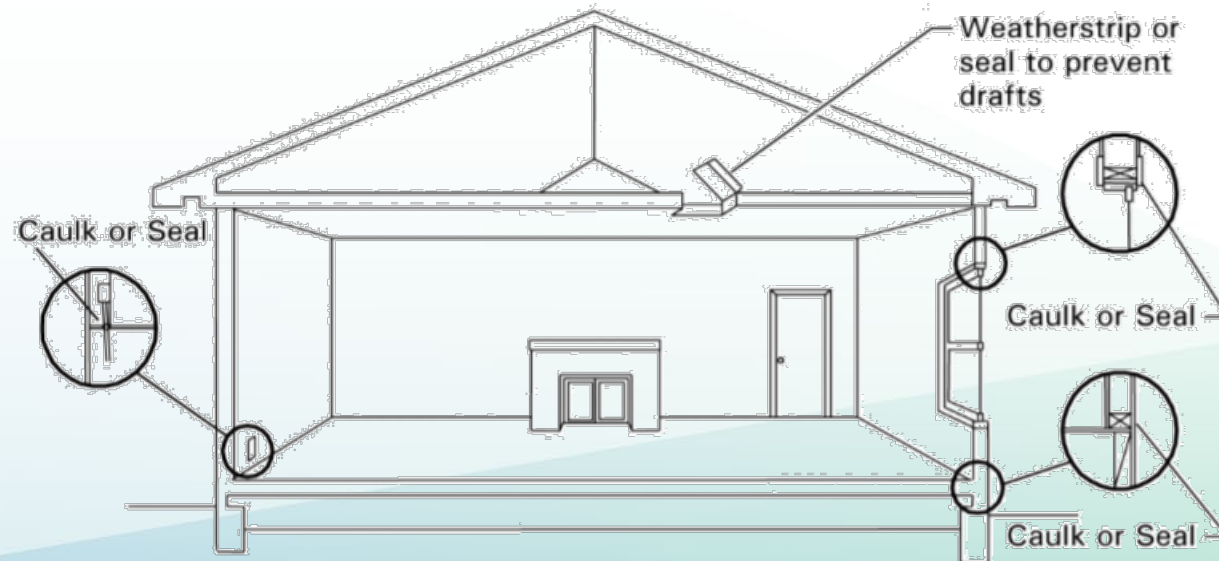
All Buildings § 110.7

Limit infiltration and exfiltration

- Must caulk, gasket, weather-strip, or seal all joints, penetrations, openings
- New [air sealing fact sheet](#)

Most overlooked
MANDATORY
requirement.
Major impacts on
energy use.

Figure 3-11: Caulking and Weatherstripping





Vapor Barriers

Residential

Mandatory § 150.0(g)



Vapor Retarder Mandatory Requirements

Residential § 150.0(g)

Vapor retarder: ability of material or assembly to limit the amount of moisture that passes through

- Class I or II vapor retarder on conditioned side of insulation in climate zones 14 and 16
 - Exterior wall
 - Vented attics
 - Unvented attics having air-permeable insulation
- On-grade Class I or II vapor retarder in all climate zones for unvented crawl spaces and controlled vent crawl spaces

Class	Permeance
Class I	≤ 0.1
Class II	> 0.1 and ≤ 1.0
Class III	< 1.0 and ≤ 10.0



Insulation and Radiant Barriers

Residential

Mandatory §§ 110.8(a-h, j), 150.0(a-d, f)

Prescriptive § 150.1(c)1-2

Alterations § 150.2(a)1



Energy Code Definitions

Exterior wall - separates conditioned space from outdoor space

Demising wall - separates conditioned space from enclosed unconditioned space

Roof - outside cover of a building, including the structural supports, decking, and top layer that is exposed to the outside

Ceiling - demising partition over conditioned space and under unconditioned space

Floor - exterior partition under conditioned space and above outdoor space

Soffit - demising partition under conditioned space and above unconditioned space



Insulation Definitions



U-factor - a measure of the heat transmission through a wall, roof, floor (all materials in assembly), or a given thickness of a material (insulation)

R-value - capacity of an insulating material to resist heat flow

Lower U-factor is better
Higher R-value is better



Insulation Mandatory Requirements

All Buildings § 110.8(a-c, h)



All Materials

- Certified to California Quality Standards for Insulation Materials by the California Department of Consumer Affairs
- Restricts use of formaldehyde foam
- Must have fire-retardant on exposed surfaces and be installed according to California Building Code

Wet insulation systems above roofs waterproof membrane

- Meet effective R-value in Reference Joint Appendix JA4.2

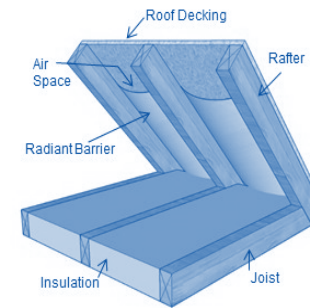


Radiant Barrier Mandatory Requirements

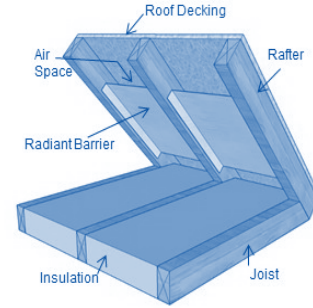
All Buildings § 110.8(j)

Radiant barriers - where required

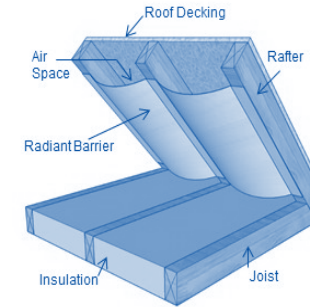
- Emittance of 0.05 or less
- Tested per ASTM
- Certified to CA Department of Consumer Affairs



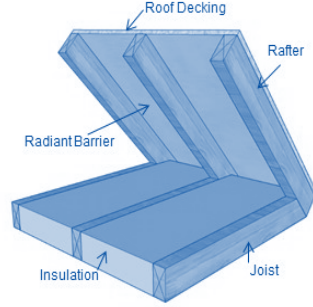
Method 1: Radiant Barrier Draped Over Top of Truss/Rafter



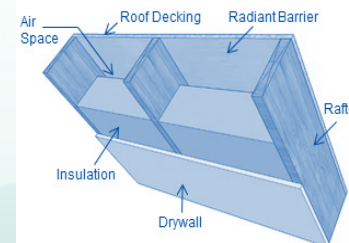
Method 2: Radiant Barrier Attached Between Truss/Rafter



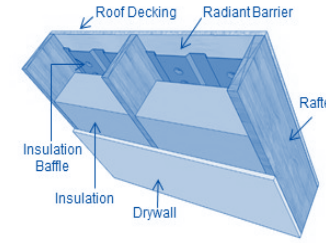
Method 3: Radiant Barrier Attached To Bottom of Truss/Rafter



Method 4: Radiant Barrier Attached To Underside of Roof Deck



Method 5: Radiant Barrier Attached to Underside of Roof Deck with Air Space



Method 6: Radiant Barrier Attached to Underside of Roof Deck with Baffle



Radiant Barrier Prescriptive Requirements

New Residential § 150.1(c)2

Radiant barrier as required per Table 150.1-A and Table 150.1-B

- Depends on climate zone
- Installed per Reference Residential Appendix RA4.2.1
 - Shiny side facing attic
 - On gable ends
 - Minimum free ventilation area





Insulation Mandatory Requirements

Residential § 150.0(a, b)



Ceiling and roof assemblies

- Maximum U-factor of 0.043
- Minimum R-22 insulation in wood frame
- Vented attic: installed at ceiling
- Unvented attic: installed at ceiling or roof
- Attic access door: insulation permanently attached
- Insulation in direct contact with air barrier

Loose-fill insulation

- Minimum installed weight per square foot to meet manufacturer's requirements



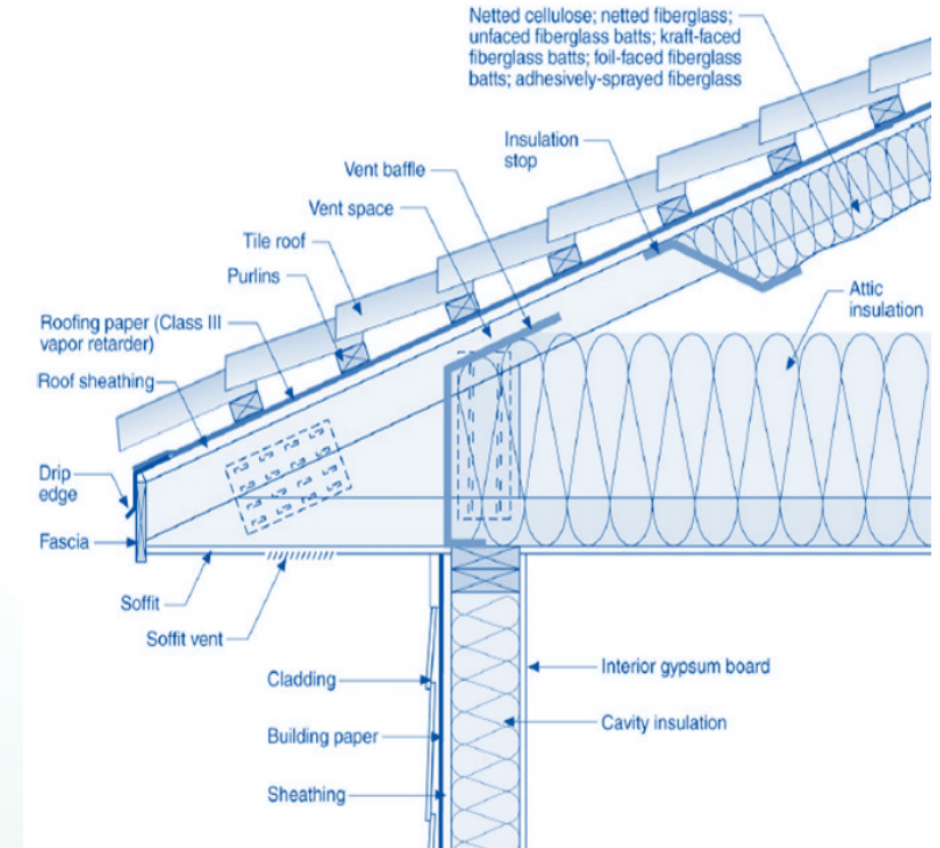
Insulation and Radiant Barrier Prescriptive Requirements

Residential § 150.1(c)1A, 2

Ceiling and roof deck insulation

Option B per Tables 150.1-A or 150.1-B

- Vented attic
- Below roof deck insulation
 - Single family R-19 in climate zones 4, 8-16
 - Multifamily R-19 in climate zones 4, 8, 9, 11-15
 - Multifamily R-13 in climate zones 10, 16
 - Roof assembly air space required
- Ceiling insulation R-30 or R-38 per Tables
- Radiant barrier in climate zones 2-3, 5-7
- Ducts insulated to R-6 or R-8 per Tables

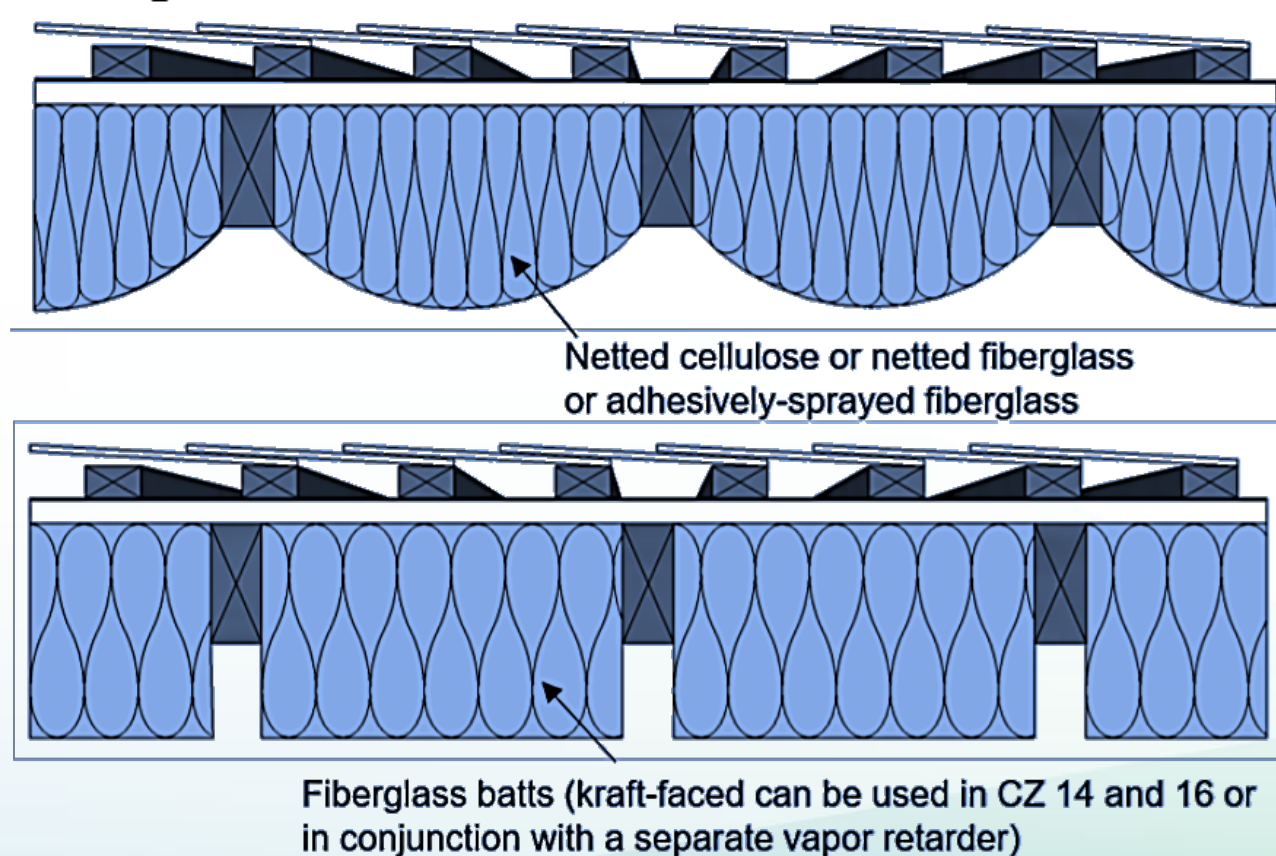




Insulation Prescriptive Requirements

Residential § 150.1(c)1A,2

Figure 3-25: Placement of Insulation Below the Roof Deck





Insulation and Radiant Barrier Prescriptive Requirements

Residential § 150.1(c)1A,2

Ceiling and roof deck insulation

Option C per Tables 150.1-A or 150.1-B

- Ducts located in conditioned space with R-6 insulation
- Meet 150.1(c)9B with HERS verification
- Ceiling insulation
 - R-38 in climate zones 1, 11-16
 - R-30 in climate zones 2-10
- Radiant barrier in climate zones 2-15



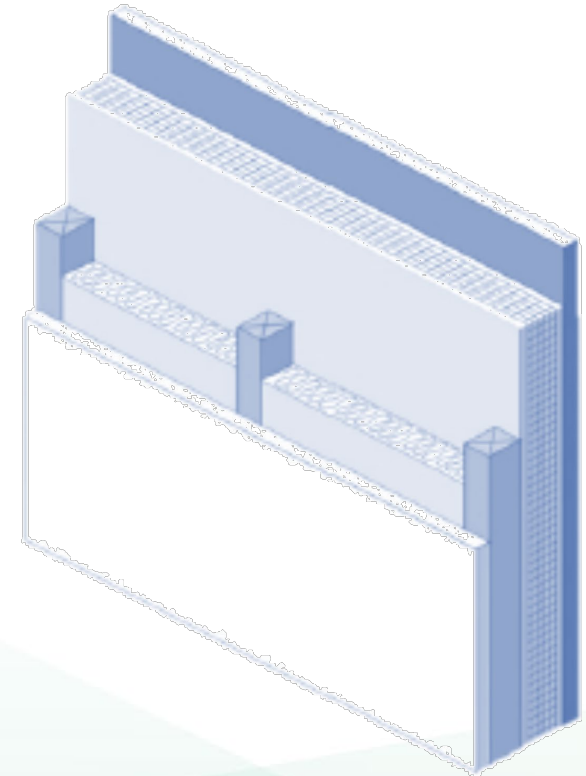


Insulation Mandatory Requirements

Residential § 150.0(c)

Wall insulation

- 2x4 walls assembly U-factor 0.102
- 2x6 walls assembly U-factor of 0.071
- Opaque non-framed assembly U-factor 0.102
- Masonry walls must meet prescriptive requirements (no trade-offs)
 - Climate zones 1-15, above grade
 - Interior insulation – U-factor 0.77
 - Exterior insulation – U-factor 0.125
 - Climate zone 16, above grade
 - Interior insulation – U-factor 0.59
 - Exterior insulation – U-factor 0.77

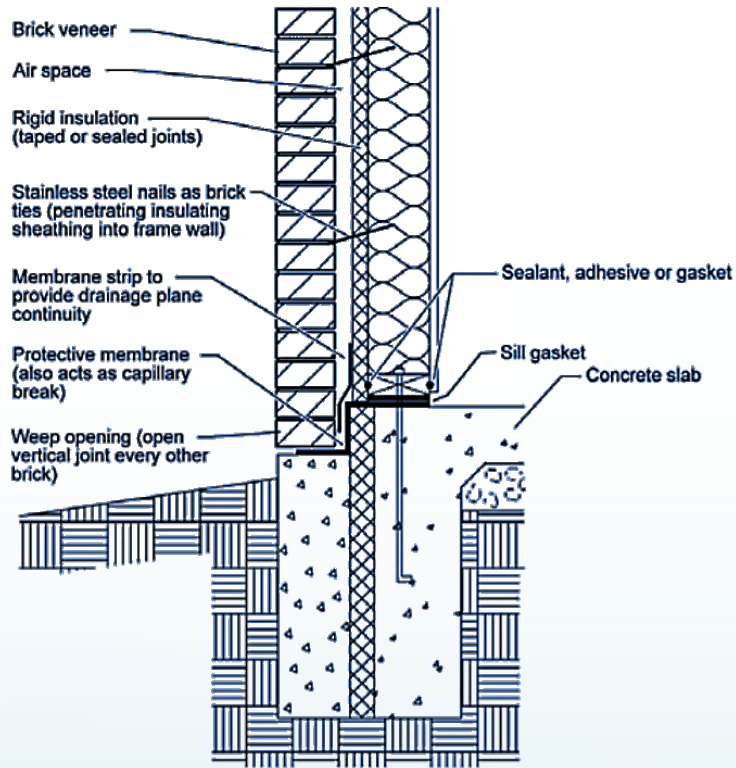




Insulation Prescriptive Requirements

Residential § 150.1(c)1B

Figure 28: Wood-Framed Wall With Brick Veneer



Wall insulation per Tables 150.1-A or 150.1-B

- Climate zones 1-5, 8-16 framed
 - Single family U-factor 0.048
 - 2x6 wood frame R-21 plus R-5
 - Multifamily U-factor 0.051
- Climate zones 6-7 framed
 - U-factor 0.065
- Mass walls above and below grade must be insulated
- All other unframed walls meet framed U-factors

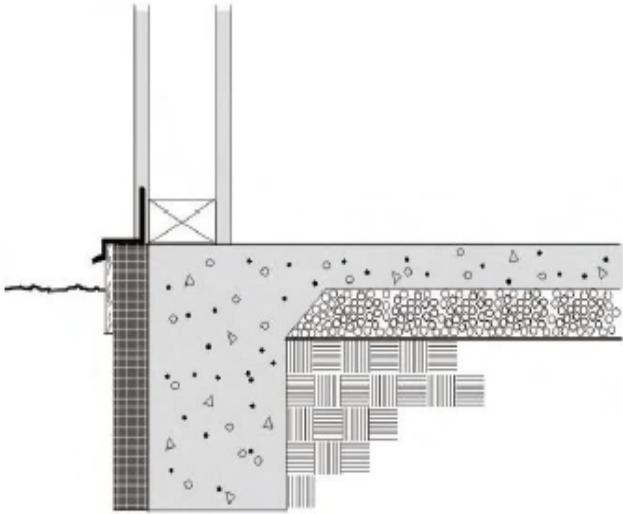


Insulation Mandatory Requirements

All Buildings § 110.8(g)

Heated slab floors

Figure 3-6: Perimeter Slab Insulation



- Meet requirements in Table 110.8-A for R-value and climate zone
- Must be certified per § 110.8(a)
- Protect exposed material to wind, equipment, moisture and UV
- Rigid plate to prevent intrusion of insects into foundation
- Requirements for direct contact with slab and grade (water absorption and vapor permeable)



Insulation Mandatory Requirements

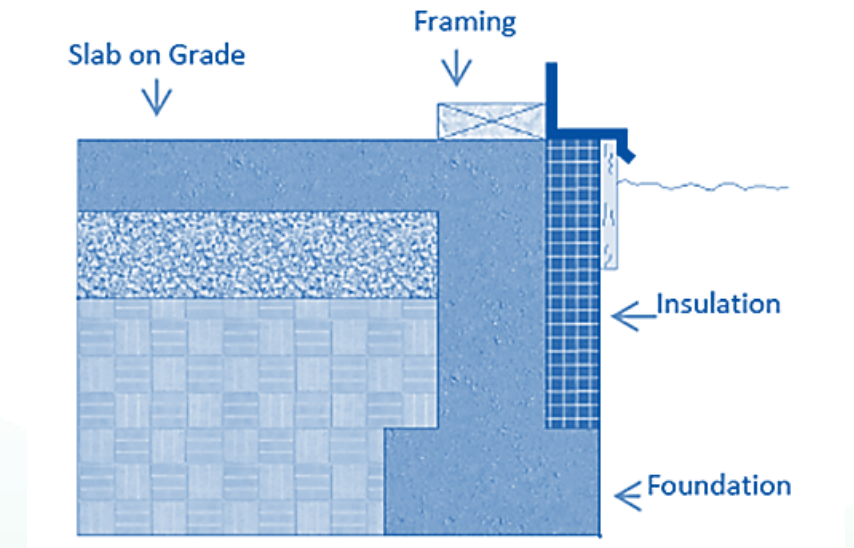
Residential § 150.0(d, f)

Raised floors

- Maximum assembly U-factor of 0.037
- Minimum R-19 insulation in wood frame

Slab edge insulation

- When required (heated slab and climate zone 16)
 - Water absorption
 - Water vapor permeance
 - Protection from UV & physical damage





Insulation Prescriptive Requirements

Residential § 150.1(c)1C, D

R-value or assembly U-factors in Table 150.1-A or Table 150.1-B

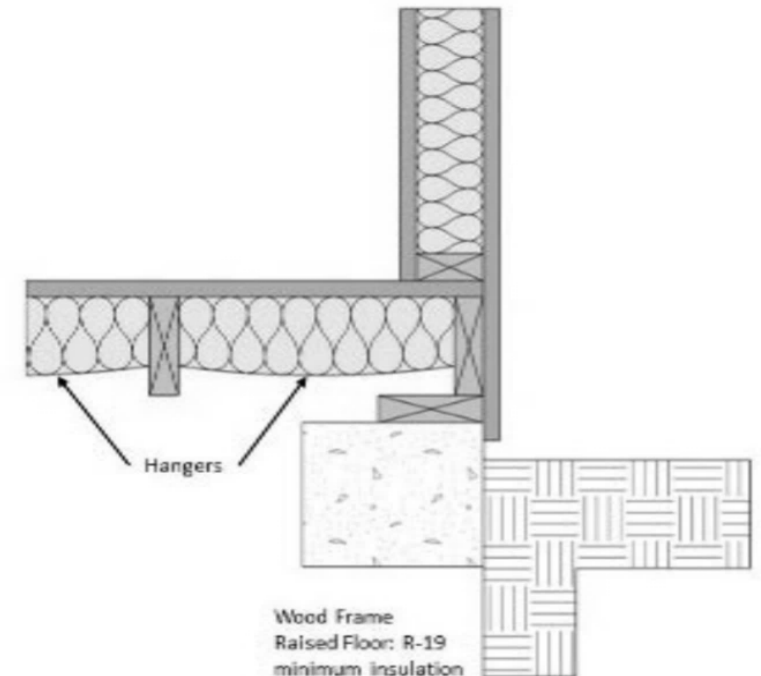
Raised floors

- Framed raised
 - Assembly U-factor 0.037
 - Minimum R-19 wood framed
- Concrete raised
 - Climate zones 1-2, 11, 13-14, 16 U-factor 0.092
 - Climate zones 3-10 U-factor 0.269
 - Climate zones 12, 15 U-factor 0.138

Slab perimeter

- Climate zone 16
 - Maximum assembly U-factor of 0.58
 - Minimum R-7 continuous insulation

Figure 3-30: Raised Floor Insulation





Quality Insulation Installation Prescriptive Requirements

Residential § 150.1(c)1E

Quality insulation installation (QII)

- Requires HERS verification of installed insulation and exterior air barrier
- Meet criteria in Reference Residential Appendix RA3.5
- Not mandatory, but difficult to offset
- Modeling without can have 7-11% penalty
- Climate zone 7 not required for multifamily



[illegible]



Insulation Prescriptive Requirements

**Table 150.1-A
Single Family
vs.
Table 150.1-B
Multifamily**

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope Insulation	Walls	Above Grade	Framed ³	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.065	U 0.065	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048
			Mass Wall Interior ^{4,5}	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.059 R 17
			Mass Wall Exterior ^{4,5}	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.077 R 13
		Below Grade	Below Grade Interior ⁶	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.067 R 15
			Below Grade Exterior ⁸	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.100 R 10	U 0.100 R 10	U 0.053 R 19
Building Envelope Insulation	Walls	Above Grade	Framed ³	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.065	U 0.065	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051	U 0.051
			Mass Wall Interior ^{4,5}	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.059 R 17
			Mass Wall Exterior ⁵	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.125 R 8	U 0.077 R 13
		Below Grade	Below Grade Interior	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.067 R 15
			Below Grade Exterior	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.200 R 5	U 0.100 R 10	U 0.100 R 10	U 0.053 R 19



Building Envelope	Floors	Slab Perimeter	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R 7
		Raised	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19
		Concrete Raised	U 0.092 R 8	U 0.092 R 8	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.092 R 8	U 0.138 R 4	U 0.092 R 8	U 0.092 R 8	U 0.138 R 4	U 0.092 R 8
	Quality Insulation Installation (QII)		Yes	Yes	Yes	Yes	Yes	Yes	NR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	



Insulation Prescriptive Requirements

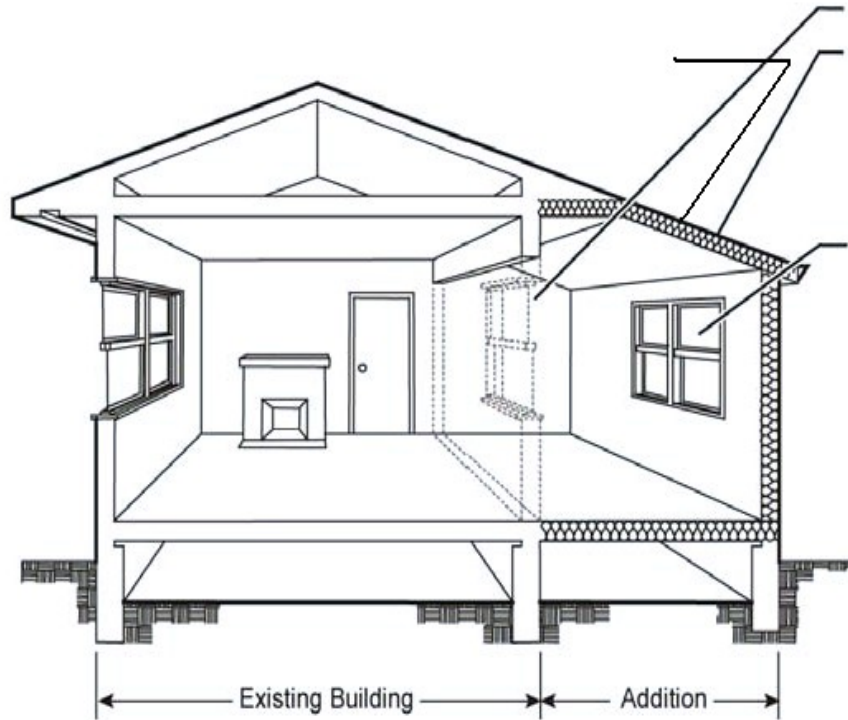
Additions § 150.2(a)1

All additions

- Existing siding not altered and wall extensions
 - R-21 in 2x6 wood-framed, no continuous
 - R-15 in 2x4 wood-framed, no continuous
 - QII exceptions
 - No insulated headers for existing doors and windows
 - No air sealing if existing air barrier not altered

Additions ≤ 700 square feet

- Ceiling insulation
 - R-38 in climate zones 1, 11-16
 - R-30 in climate zones 2-10
 - Radiant barrier in climate zones 2-15
 - Exception: R-22 allowed in rafter roofs
- QII not required





Insulation Mandatory Requirements

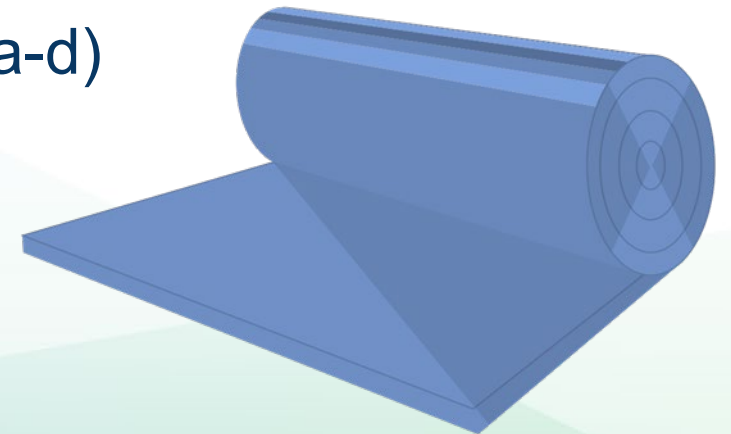
Alterations §§ 110.8(d), 150.2(b)

Ceiling and roof insulation

- R-value of new insulation and existing insulation are combined
 - If space is too small to meet required R-value: must fill entire space (compliant with Part 2, § 1203.2)

All insulation in altered components

- Meet mandatory requirements in § 150.0(a-d)





Test Your Knowledge

Residential

Should insulation be installed against the radiant barrier?

No, radiant barriers need an airspace to work properly and provide maximum benefits.

- Table 150.1-A and Table 150.1-B only require radiant barrier when there is no insulation under the roof deck





Roofing Materials

Residential

Administrative § 10-113

Mandatory § 110.8(i)

Prescriptive § 150.1(c)

Additions and Alterations § 150.2(a-b)



Roofing Definitions

Low-sloped - rise to run less than 2:12

Steep-sloped - rise to run of 2:12 or greater

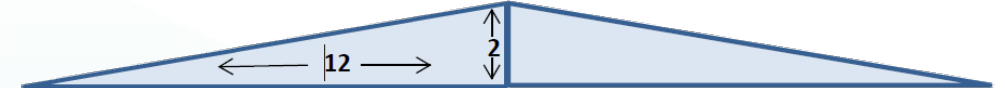
Solar reflectance (SR) - ability to reflect solar energy from the sun back into the atmosphere

Thermal emittance (TE) - the ability to release heat that has been absorbed

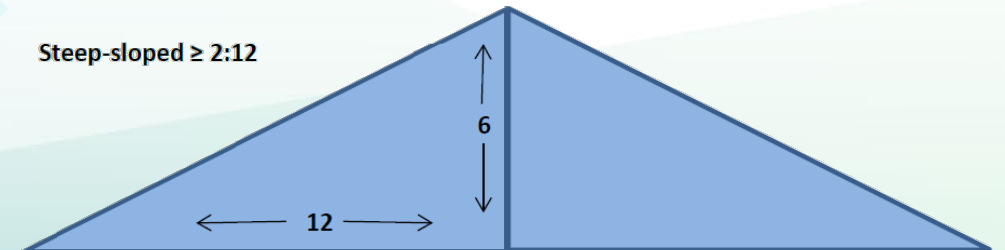
Solar reflectance index (SRI) - combines SR three-year aged value and TE in an equation

The higher the number, the cooler the roof.

Low-sloped < 2:12



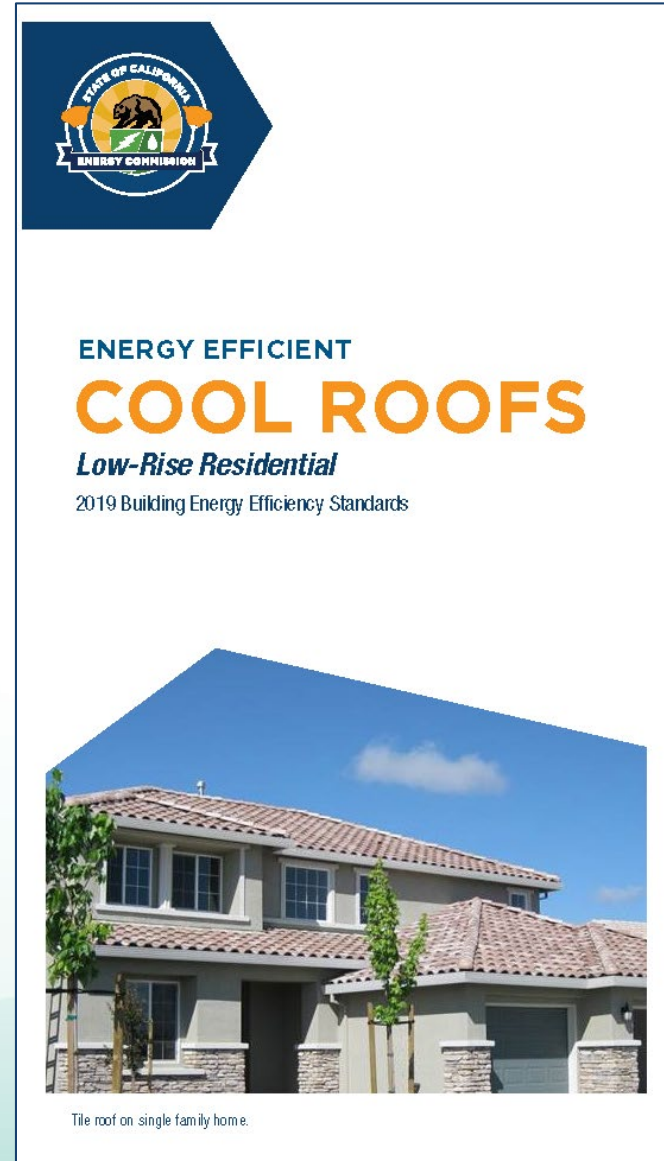
Steep-sloped \geq 2:12





Residential Cool Roof Brochure

- A cool roof will reflect more sunlight and absorb less heat than a standard roof
- Helps lower roof and attic temperatures on hot, sunny days to reduce the need for air conditioning
- The roofing product must meet minimum solar reflectance and thermal emittance values for Energy Code compliance





Roofing Administrative Regulations


All Buildings § 10-113

Certification requirements

- Cool Roof Rating Council (CRRC) is responsible for certifying

Labeling requirements

- Solar Reflectance and Thermal Emittance must be listed

 CRRC COOL ROOF RATING COUNCIL ®	Solar Reflectance	<u>Initial</u> 0.00	<u>Weathered</u> Pending
	Thermal Emittance	0.00	Pending
	Rated Product ID Number — — — —		
	Licensed Seller ID Number — — — —		
	Classification Production Line		
<small>Cool Roof Rating Council ratings are determined for a fixed set of conditions, and may not be appropriate for determining seasonal energy performance. The actual effect of solar reflectance and thermal emittance on building performance may vary.</small>			
<small>Manufacturer of product stipulates that these ratings were determined in accordance with the applicable Cool Roof Rating Council procedures.</small>			



Roofing Mandatory Requirements

All Buildings § 110.8(i)

Roofing products

- Meet aged solar reflectance and thermal emittance thresholds
- Certified and labeled per § 10-113
- Default values for non-certified products
- SRI may be used as alternative to aged SR and TE values
- Liquid-applied roof coatings to meet Table 110.8-C requirements for coverage and thickness



Roofing Prescriptive Requirements

Residential § 150.1(c)11

Roofing product requirements per Table 150.1-A or Table 150.1-B

- Steep-sloped roofs in climate zones 10-15
 - Minimum aged solar reflectance of 0.20
 - Minimum thermal emittance of 0.75
 - OR minimum solar reflectance index of 16
- Low-sloped roofs in climate zones 13 and 15
 - Minimum aged solar reflectance of 0.63
 - Minimum thermal emittance of 0.75
 - OR minimum solar reflectance index of 75



Roofing Prescriptive Requirements

Residential Table 150.1-A and Table 150.1-B

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope	Roofing Products	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	0.63	NR
			Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR
		Steep-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR
			Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR

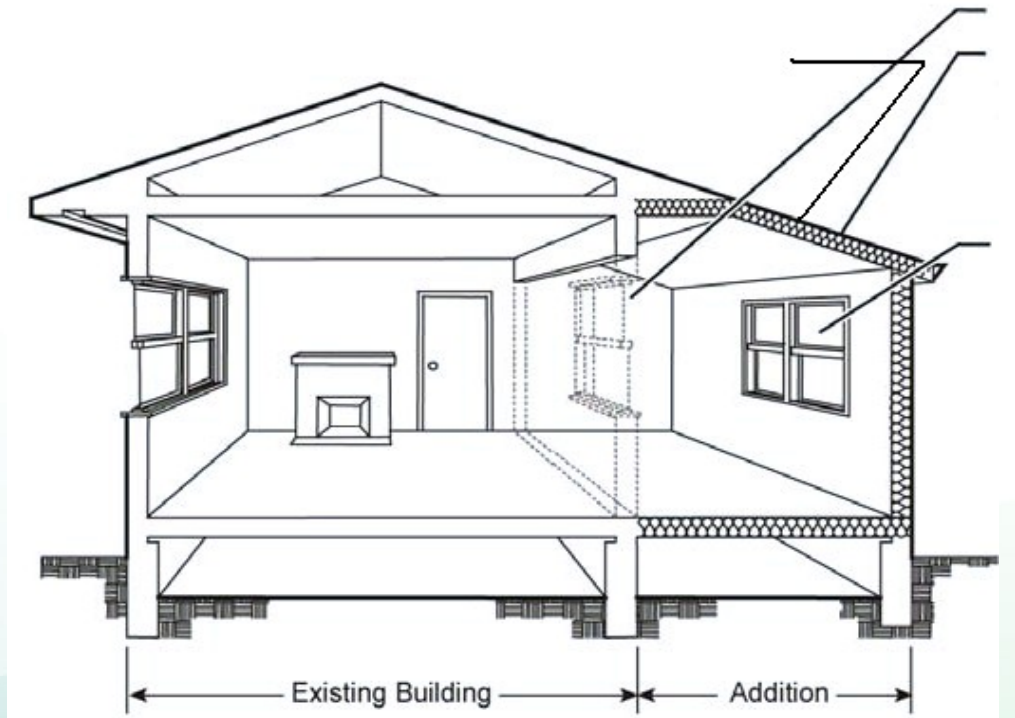


Roofing Prescriptive Requirements

Additions § 150.2(a)

Meet prescriptive requirements in § 150.1(c)11

- Additions of 300 square feet or less:
 -  Cool roof not required





Roofing Prescriptive Requirements

Alterations § 150.2(b)1I

When replacing more than 50% of roof:

- Same as prescriptive requirements in § 150.1(c)1I
- Only the altered roofing area must comply
- Exceptions:
 - Steep-sloped
 - 1" air space between roof deck and roofing
 - Roof product profile ratio of 1:5 or more
 - Seal and insulate existing ducts per § 150.1(c)9
 - R-38 ceiling insulation
 - Radiant barrier
 - No ducts in attic
 - Above roof deck insulation of R-2 or more
 - Low-sloped
 - No ducts in attic
 - Lower aged SR with added roof deck insulation per Table 150.2-B



Test Your Knowledge

Does an alteration to the roof of an unconditioned detached garage trigger cool roof requirements?

No, alterations to the roof of an unconditioned detached garage do not trigger cool roof requirements

- Building envelope requirements usually do not apply to unconditioned buildings





Plan Check and Inspection



Plans Examiners

- Verify required fenestration values
- Verify required door values
- Verify required insulation values
 - Remember mandatory assembly U-factors
- Should have QII, with HERS
- Verify CF1R values match plans
- Penalized if R-values are less, or if U-factors and SHGCs are more

STATE OF CALIFORNIA
NEWLY CONSTRUCTED BUILDINGS
CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE
Prescriptive Newly Constructed Buildings
Project Name: _____ Date Prepared: _____

CF1R-NCB-01-E
(Page 1 of 9)

A. General Information											
01	Project Name:						02	Date Prepared:			
03	Project Location:						04	Building Front Orientation (deg or cardinal):			
05	CA City:						06	Number of Dwelling Units:			
07	Zip Code:						08	Fuel Type:			
09	Climate Zone:						10	Total Conditioned Floor Area (ft²):			
11	Building Type:						12	Slab Area (ft²):			
13	Project Scope:						14	Exceptions to Fenestration U-factor & SHGC 150.1(c)(3A):			

B. Opaque Surface Details – Framed Walls/ Framed Floors/Concrete Raised Floors (Section 150.1(c)(1))											
01	02	03	04	05	06	07	08	09	10	11	12
Tag/ID	Assembly Type	Frame Type	Frame Depth (inches)	Frame Spacing (inches)	Cavity R-value	Continuous Insulation R-value	Proposed		Required		Comments
							U-Factor	Appendix JA4 Reference	U-Factor from Table 150.1-A or B		
Table	Cell										

C. Opaque Surface Details – Nonframed (Section 150.1(c)(1))									
01	02	03	04	05	06	07	08	09	10
Tag/ID	Assembly Materials	Thickness (inches)	Core Insulation R-value	Continuous Insulation R-value	U-Factor	Proposed		Required	
						Table	Cell	U-Factor from Table 150.1-A or B	Comments

Registration Number: _____ Registration Date/Time: _____ HERS Provider: _____
CA Building Energy Efficiency Standards - 2019 Residential Compliance January 2019



CERTIFICATE OF COMPLIANCE

Project Name: Sample House

Calculation Description: Title 24 Analysis

Calculation Date/Time: 2019-07-08T18:42:27-07:00

Input File Name: Sample T24 2019 CBECC.ribd19

CF1R-PRF-01E

(Page 3 of 12)

CF1R-PRF-01

REQUIRED SPECIAL FEATURES

The following are features that must be installed as condition for meeting the modeled energy performance for this computer analysis.

- PV System: 2.68 kWdc
- Whole house fan
- Cool roof
- Insulation below roof deck
- Window overhangs and/or fins

HERS FEATURE SUMMARY

The following is a summary of the features that must be field-verified by a certified HERS Rater as a condition for meeting the modeled energy performance for this computer analysis. Additional detail is provided in the building tables below. Registered CF2Rs and CF3Rs are required to be completed in the HERS Registry

Building-level Verifications:

- Quality insulation installation (QII)
- IAQ mechanical ventilation
- Kitchen range hood
- Whole House Fan Airflow and Fan Efficacy

Cooling System Verifications:

- Minimum Airflow
- Verified EER
- Verified Refrigerant Charge
- Fan Efficacy Watts/CFM

Heating System Verifications:

- -- None --

HVAC Distribution System Verifications:

- Duct Sealing

Domestic Hot Water System Verifications:

- -- None --

BUILDING - FEATURES INFORMATION

01	02	03	04	05	06	07
Project Name	Conditioned Floor Area (ft ²)	Number of Dwelling Units	Number of Bedrooms	Number of Zones	Number of Ventilation Cooling Systems	Number of Water Heating Systems
Sample House	1751	1	3	1	1	1

**CERTIFICATE OF COMPLIANCE**

Project Name: Sample House

Calculation Description: Title 24 Analysis

Calculation Date/Time: 2019-07-08T18:42:27-07:00

Input File Name: Sample T24 2019 CBECC.ribd19

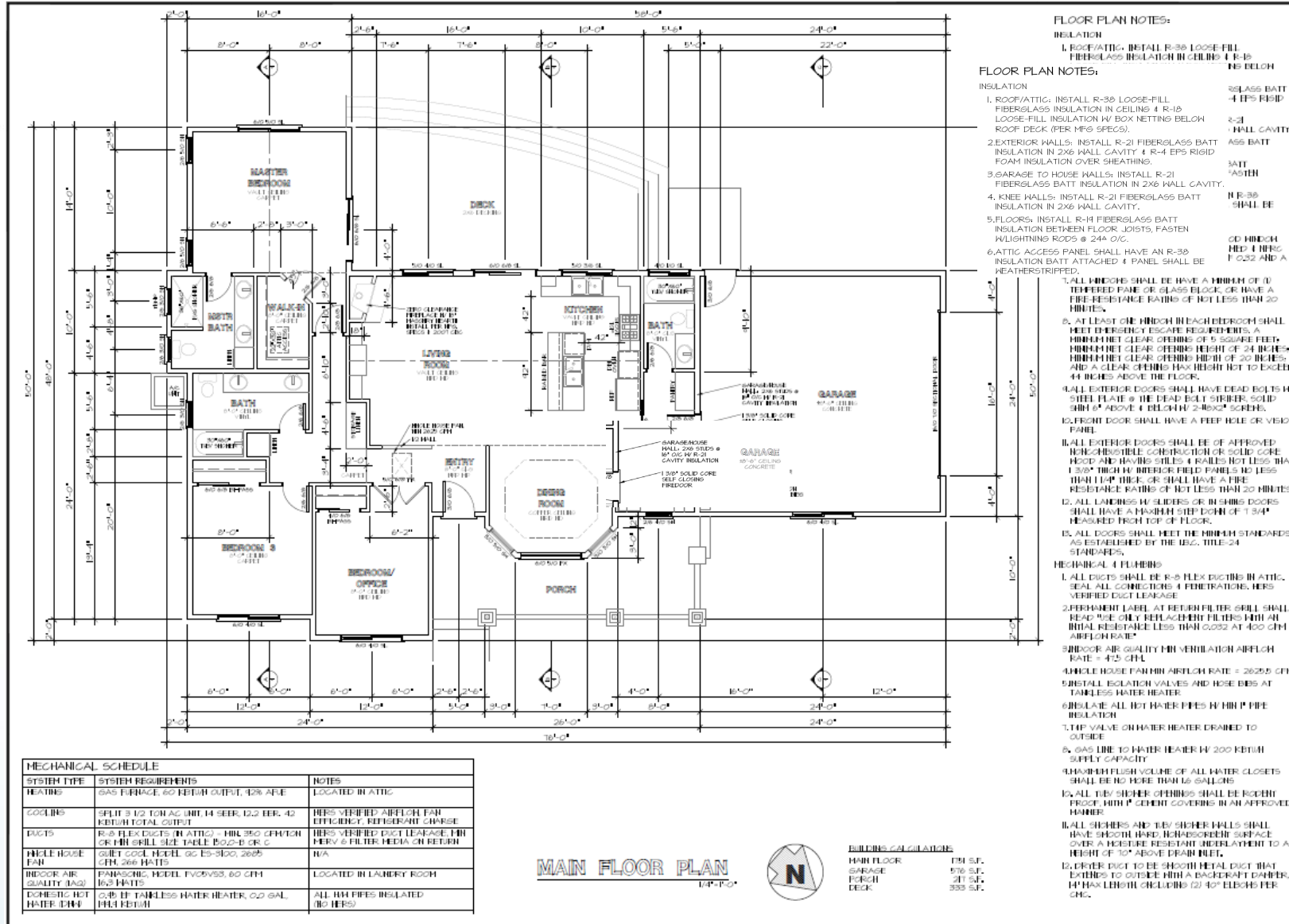
CF1R-PRF-01E

(Page 7 of 12)

CF1R-PRF-01

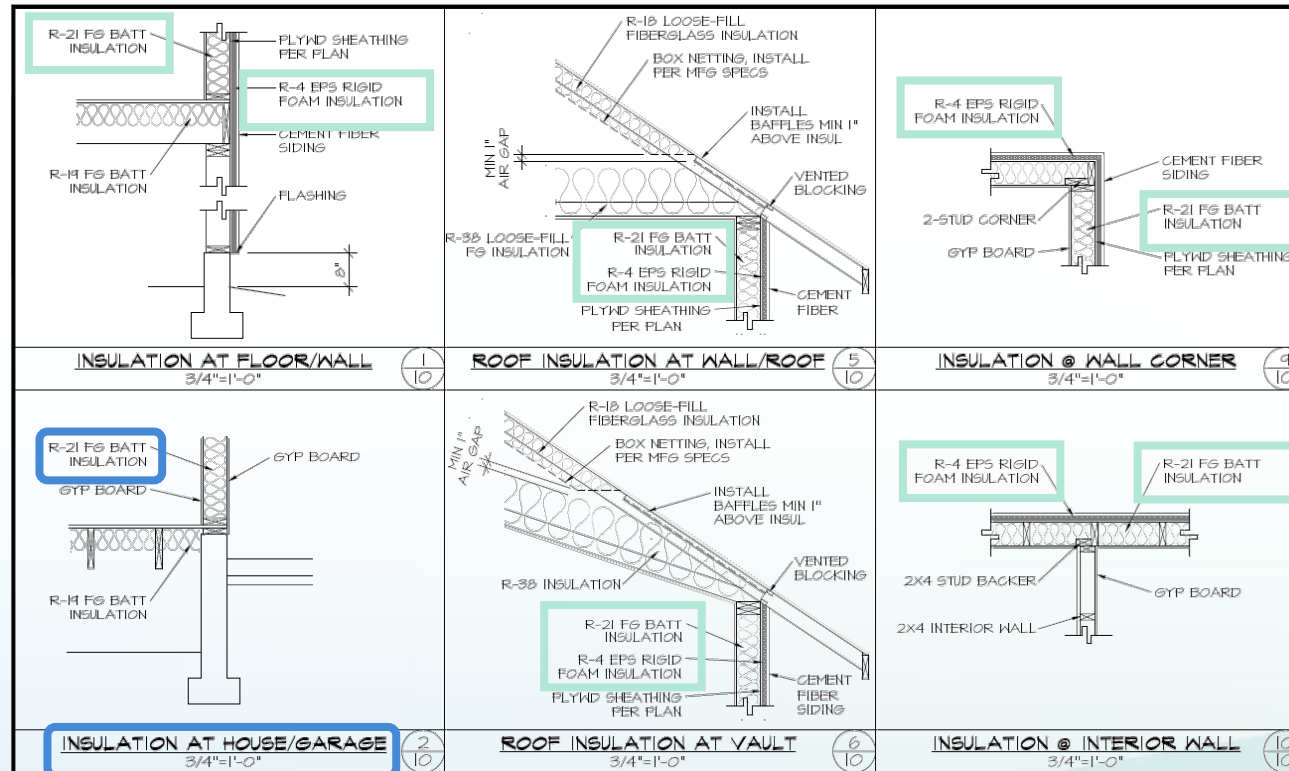
SLAB FLOORS						
01	02	03	04	05	06	07
Name	Zone	Area (ft2)	Perimeter (ft)	Edge Insul. R-value & Depth	Carpeted Fraction	Heated
Slab-on-Grade	__Garage__	576	72	None	0%	No

OPAQUE SURFACE CONSTRUCTIONS							
01	02	03	04	05	06	07	08
Construction Name	Surface Type	Construction Type	Framing	Total Cavity R-value	Interior / Exterior Continuous R-value	U-factor	Assembly Layers
Garage Wall	Exterior Walls	Wood Framed Wall	2x4 @ 16 in. O. C.	No insulation	n/a	0.361	Inside Finish: Gypsum Board Cavity / Frame: no insul. / 2x4 Exterior Finish: 3 Coat Stucco
Exterior Wall: R-21+R-4	Exterior Walls	Wood Framed Wall	2x6 @ 16 in. O. C.	R-21	n/a	0.051	Inside Finish: Gypsum Board Cavity / Frame: R-21 / 2x6 Sheathing / Insulation: R4 Sheathing Exterior Finish: 3 Coat Stucco
Demising Wall: R-21	Interior Walls	Wood Framed Wall	2x6 @ 16 in. O. C.	R-21	n/a	0.064	Inside Finish: Gypsum Board Cavity / Frame: R-21 / 2x6 Other Side Finish: Gypsum Board
Attic Garage Roof Cons	Attic Roofs	Wood Framed Ceiling	2x4 Top Chord of Roof Truss @ 24 in. O. C.	No insulation	n/a	0.644	Cavity / Frame: no insul. / 2x4 Top Chrd Roof Deck: Wood Siding/sheathing/decking Roofing: Light Roof (Asphalt Shingle)
Attic RoofHouse	Attic Roofs	Wood Framed Ceiling	2x4 Top Chord of Roof Truss @ 24 in. O. C.	R 18	n/a	0.055	Under Roof Joists: R-5.0 insul. Cavity / Frame: R-13.0 / 2x4 Top Chrd Roof Deck: Wood Siding/sheathing/decking Roofing: Light Roof (Asphalt Shingle)





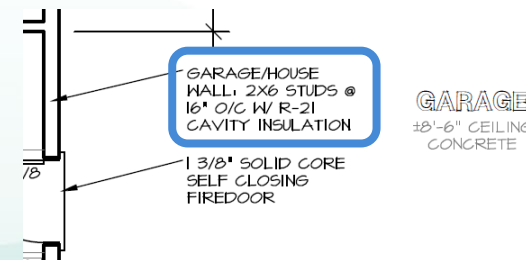
Construction Name	Surface Type	Construction Type	Framing	Total Cavity R-value	Interior / Exterior Continuous R-value	U-factor	Assembly Layers
Garage Wall	Exterior Walls	Wood Framed Wall	2x4 @ 16 in. O. C.	No insulation	n/a	0.361	Inside Finish: Gypsum Board Cavity / Frame: no insul. / 2x4 Exterior Finish: 3 Coat Stucco
Exterior Wall: R-21+R-4	Exterior Walls	Wood Framed Wall	2x6 @ 16 in. O. C.	R-21	n/a	0.051	Inside Finish: Gypsum Board Cavity / Frame: R-21 / 2x6 Sheathing / Insulation: R4 Sheathing Exterior Finish: 3 Coat Stucco
Demising Wall: R-21	Interior Walls	Wood Framed Wall	2x6 @ 16 in. O. C.	R-21	n/a	0.064	Inside Finish: Gypsum Board Cavity / Frame: R-21 / 2x6 Other Side Finish: Gypsum Board



FLOOR PLAN NOTES:

INSULATION

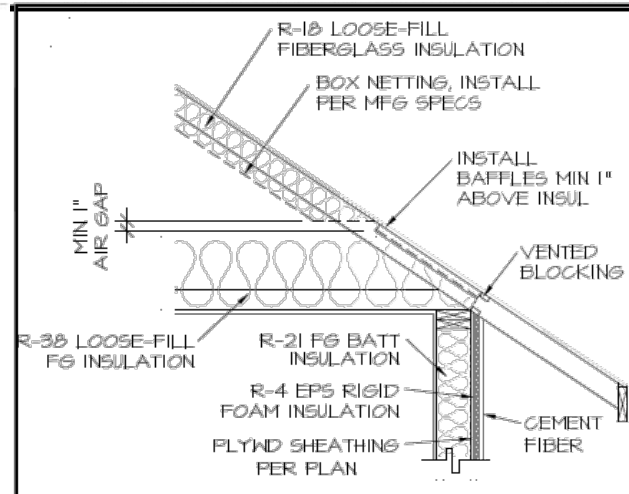
1. ROOF/ATTIC: INSTALL R-38 LOOSE-FILL FIBERGLASS INSULATION IN CEILING & R-18 LOOSE-FILL INSULATION W/ BOX NETTING BELOW ROOF DECK (PER MFG SPECS).
2. EXTERIOR WALLS: INSTALL R-21 FIBERGLASS BATT INSULATION IN 2X6 WALL CAVITY & R-4 EPS RIGID FOAM INSULATION OVER SHEATHING.
3. GARAGE TO HOUSE WALLS: INSTALL R-21 FIBERGLASS BATT INSULATION IN 2X6 WALL CAVITY.
4. KNEE WALLS: INSTALL R-21 FIBERGLASS BATT INSULATION IN 2X6 WALL CAVITY.
5. FLOORS: INSTALL R-14 FIBERGLASS BATT INSULATION BETWEEN FLOOR JOISTS, FASTEN W/ LIGHTNING RODS @ 24\"/>





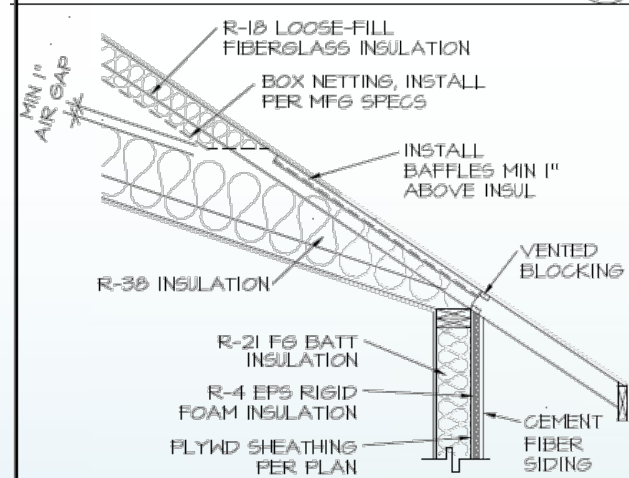
CF1R-PRF-01

OPAQUE SURFACE CONSTRUCTIONS							
01	02	03	04	05	06	07	08
Construction Name	Surface Type	Construction Type	Framing	Total Cavity R-value	Interior / Exterior Continuous R-value	U-factor	Assembly Layers
Garage Wall	Exterior Walls	Wood Framed Wall	2x4 @ 16 in. O. C.	No insulation	n/a	0.361	Inside Finish: Gypsum Board Cavity / Frame: no insul. / 2x4 Exterior Finish: 3 Coat Stucco
Exterior Wall: R-21+R-4	Exterior Walls	Wood Framed Wall	2x6 @ 16 in. O. C.	R-21	n/a	0.051	Inside Finish: Gypsum Board Cavity / Frame: R-21 / 2x6 Sheathing / Insulation: R4 Sheathing Exterior Finish: 3 Coat Stucco
Demising Wall: R-21	Interior Walls	Wood Framed Wall	2x6 @ 16 in. O. C.	R-21	n/a	0.064	Inside Finish: Gypsum Board Cavity / Frame: R-21 / 2x6 Other Side Finish: Gypsum Board
Attic Garage Roof Cons	Attic Roofs	Wood Framed Ceiling	2x4 Top Chord of Roof Truss @ 24 in. O. C.	No insulation	n/a	0.644	Cavity / Frame: no insul. / 2x4 Top Chrd Roof Deck: Wood Siding/sheathing/decking Roofing: Light Roof (Asphalt Shingle)
Attic RoofHouse	Attic Roofs	Wood Framed Ceiling	2x4 Top Chord of Roof Truss @ 24 in. O. C.	R 18	n/a	0.055	Under Roof Joists: R-5.0 insul. Cavity / Frame: R-13.0 / 2x4 Top Chrd Roof Deck: Wood Siding/sheathing/decking Roofing: Light Roof (Asphalt Shingle)
R-19 Floor Crawlspace	Floors Over Crawlspace	Wood Framed Floor	2x6 @ 16 in. O. C.	R 18	n/a	0.05	Floor Surface: Carpeted Floor Deck: Wood Siding/sheathing/decking Cavity / Frame: R-19 in 5-1/2 in. (R-18) / 2x6
Garage Roof Attic	Ceilings (below attic)	Wood Framed Ceiling	2x4 @ 16 in. O. C.	No insulation	n/a	0.472	Inside Finish: Gypsum Board Cavity / Frame: no insul. / 2x4
High Performance	Ceilings (below attic)	Wood Framed Ceiling	2x4 @ 16 in. O. C.	R-38	n/a	0.025	Inside Finish: Gypsum Board Cavity / Frame: R-9.1 / 2x4 Over Ceiling Joists: R-28.9 insul.



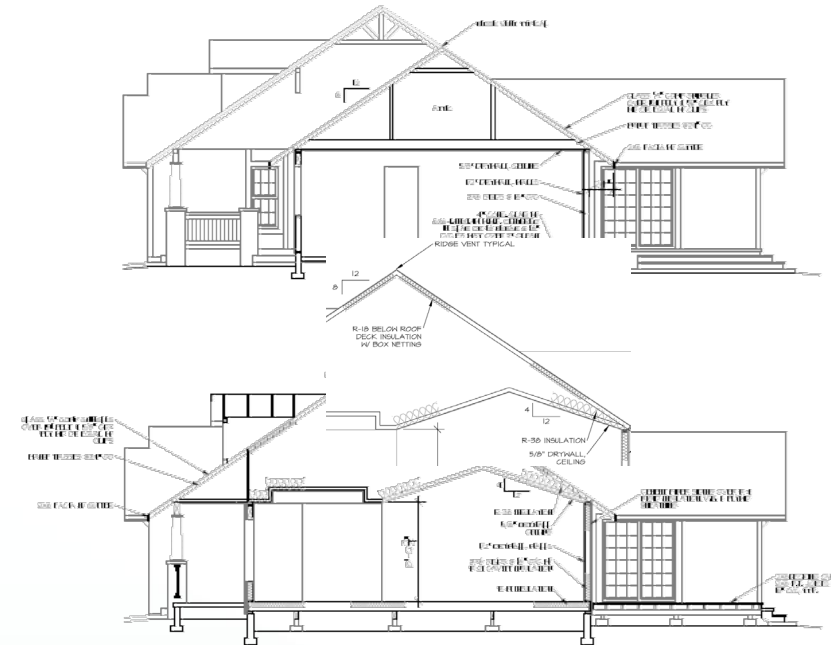
ROOF INSULATION AT WALL/ROOF
3/4"=1'-0"

5
10

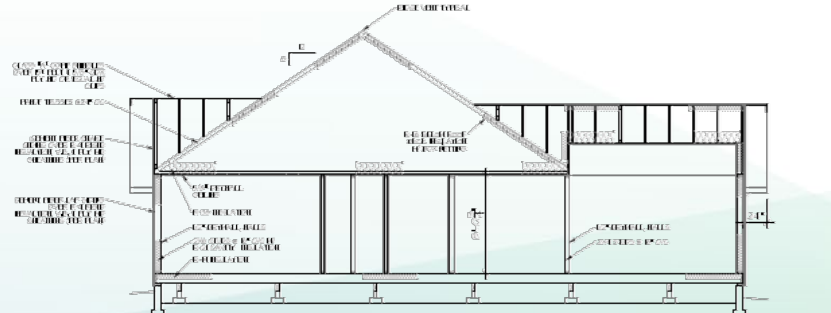


ROOF INSULATION AT VAULT
3/4"=1'-0"

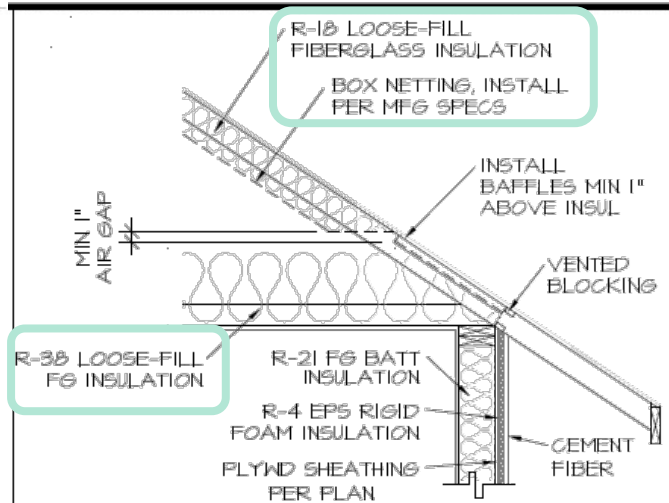
6
10



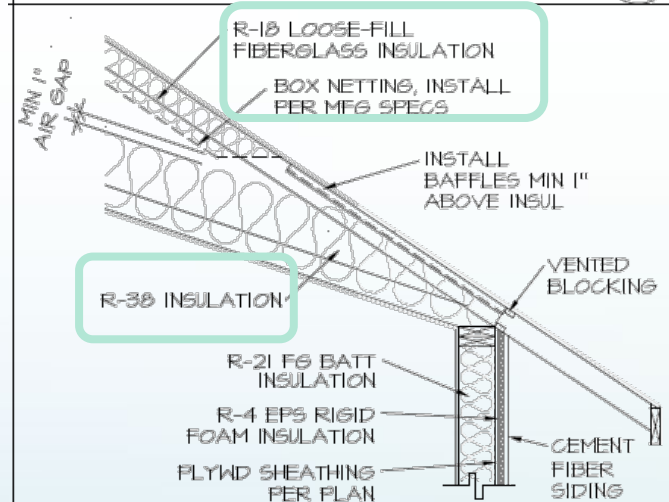
SECTION B-B
1/4"=1'-0"



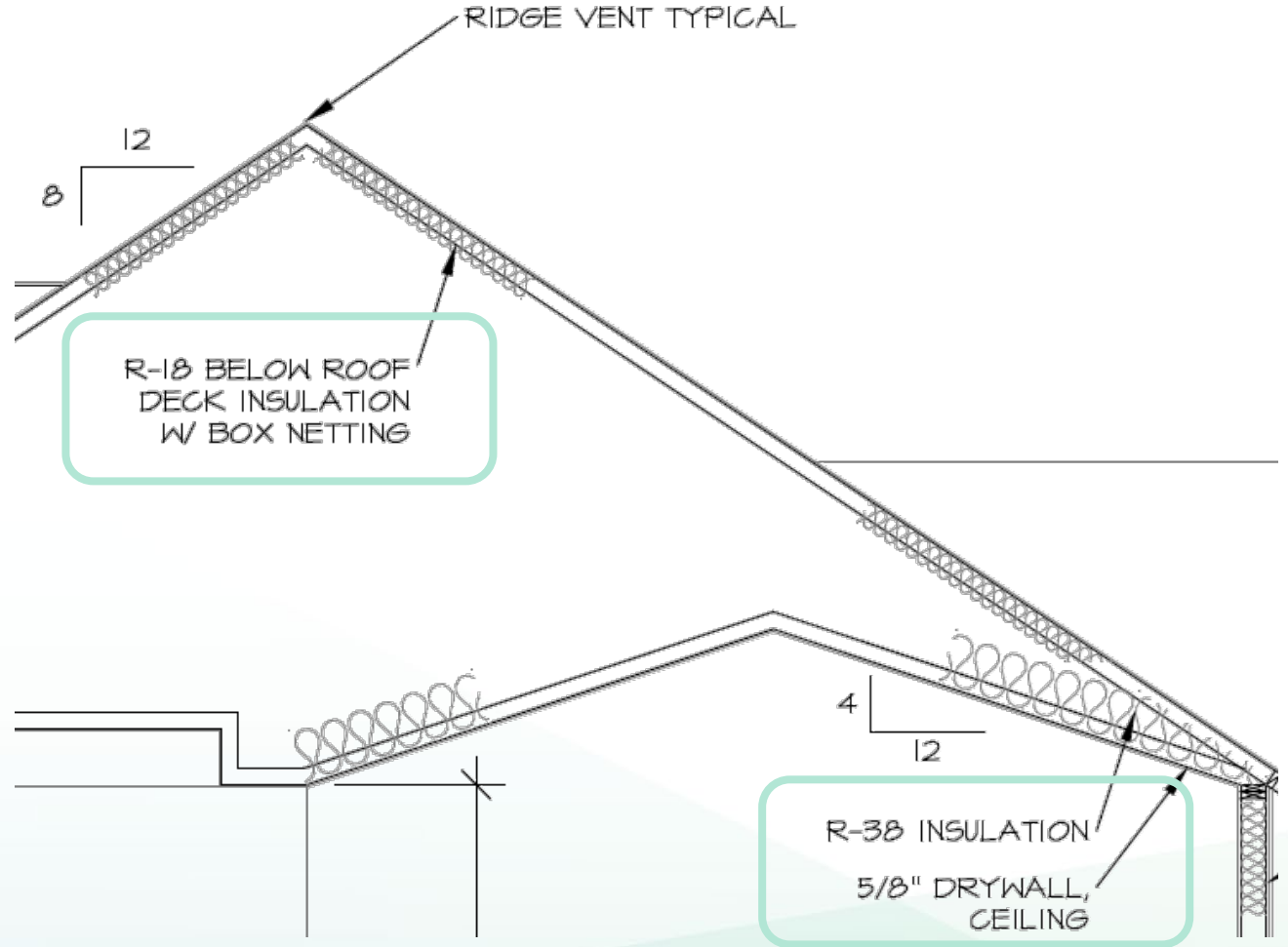
SECTION C-C
1/4"=1'-0"



ROOF INSULATION AT WALL/ROOF 5
3/4"=1'-0" 10



ROOF INSULATION AT VAULT 6
3/4"=1'-0" 10





CERTIFICATE OF COMPLIANCE

Project Name: Sample House

Calculation Description: Title 24 Analysis

Calculation Date/Time: 2019-07-08T18:42:27-07:00

Input File Name: Sample T24 2019 CBECC.ribd19

CF1R-PRF-01E

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WINDOWS & DOORS

6. ALL WINDOWS SHALL BE "REALLY GOOD WINDOW CO." SERIES: "BEST EVER" VINYL FRAMED & NFRC RATED WITH A MAXIMUM U-FACTOR OF 0.32 AND A MAXIMUM SHGC OF 0.25.

7. ALL WINDOWS SHALL BE HAVE A MINIMUM OF (1) TEMPERED PANE OR GLASS BLOCK, OR HAVE A FIRE-RESISTANCE RATING OF NOT LESS THAN 20 MINUTES.

8. AT LEAST ONE WINDOW IN EACH BEDROOM SHALL MEET EMERGENCY ESCAPE REQUIREMENTS. A MINIMUM NET CLEAR OPENING OF 5 SQUARE FEET; MINIMUM NET CLEAR OPENING HEIGHT OF 24 INCHES; MINIMUM NET CLEAR OPENING WIDTH OF 20 INCHES; AND A CLEAR OPENING MAX HEIGHT NOT TO EXCEED 44 INCHES ABOVE THE FLOOR.

9. ALL EXTERIOR DOORS SHALL HAVE DEAD BOLTS W/ STEEL PLATE @ THE DEAD BOLT STRIKER, SOLID SHIM 6" ABOVE & BELOW W/ 2-#8X2" SCREWS.

10. FRONT DOOR SHALL HAVE A PEEP HOLE OR VISION PANEL

11. ALL EXTERIOR DOORS SHALL BE OF APPROVED NONCOMBUSTIBLE CONSTRUCTION OR SOLID CORE WOOD AND HAVING STILES & RAILES NOT LESS THAN 1 3/8" THICK W/ INTERIOR FIELD PANELS NO LESS THAN 1 1/4" THICK, OR SHALL HAVE A FIRE RESISTANCE RATING OF NOT LESS THAN 20 MINUTES.

12. ALL LANDINGS W/ SLIDERS OR IN SWING DOORS SHALL HAVE A MAXIMUM STEP DOWN OF 1 3/4" MEASURED FROM TOP OF FLOOR.

13. ALL DOORS SHALL MEET THE MINIMUM STANDARDS AS ESTABLISHED BY THE I.B.C. TITLE-24 STANDARDS.

06	07	08	09	10	11	12	13	14
th (ft)	Height (ft)	Mult.	Area (ft²)	U-factor	U-factor Source	SHGC	SHGC Source	Exterior Shading
2.5	4	1	10	0.32	NFRC	0.25	NFRC	Insect Screen (default)
6	5	1	30	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	24	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	24	0.32	NFRC	0.25	NFRC	Insect Screen (default)
3	5	1	15	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	7.5	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	7.5	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	7.5	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	12.5	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	12.5	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	30	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	20	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	40	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	17.5	0.32	NFRC	0.25	NFRC	Insect Screen (default)
		1	4	0.32	NFRC	0.25	NFRC	Insect Screen (default)



Field Inspectors



At foundation verify

- Slab edge insulation (if applicable)

At rough frame verify

- Air sealing
- Window and skylight values
- Cool roof (if applicable)

At insulation stage verify

- Wall and raised floor insulation values
- QII (requires HERS)

At final verify

- Ceiling insulation values
- CF2R and CF3R installation forms
- Registered with HERS Provider
- Request project status report (PSR)



Resources



Online Resource Center

Online Resource Center

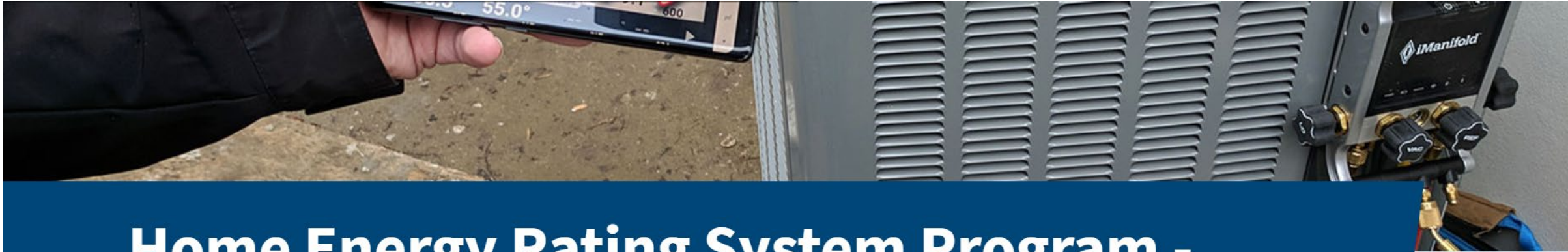
Educational documents and training information for building communities and enforcement agencies to assist with building energy standards compliance.

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2019 HERS Providers



Home Energy Rating System Program - HERS

The Home Energy Rating System (HERS) Program tests and rates the energy performance of a home. The California Energy Commission's HERS Program addresses construction defects and poor equipment installation, including HVAC systems and insulation. The Energy Commission has a list of approved HERS providers who train and certify raters.

SUBSCRIBE

Building Energy Efficiency Standards

First Name *



Blueprint Newsletter

Blueprint Newsletter

Blueprint is the California Energy Commission's quarterly e-newsletter that delves into the Building Energy Efficiency Standards and provides examples of projects. The newsletter provides updates, answers to frequently asked questions, clarifications to requirements, announcements, and educational resources and training.

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Thank you