We will be starting soon!

Thanks for joining us

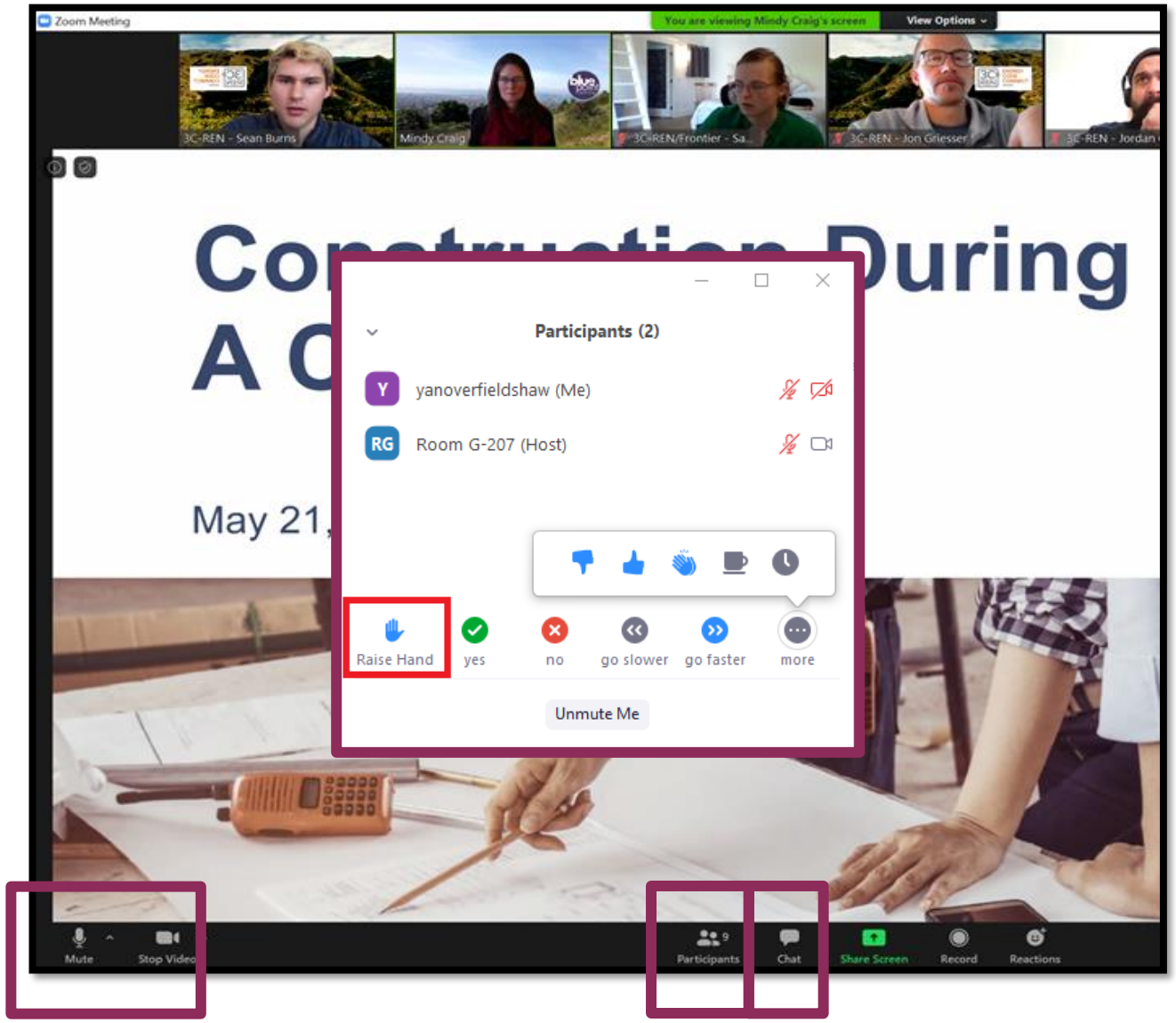
2022 *Single Family* Residential Envelopes and the 2022 Energy Code

Russell King, ME – Coded Energy, Inc.

January 26, 2023

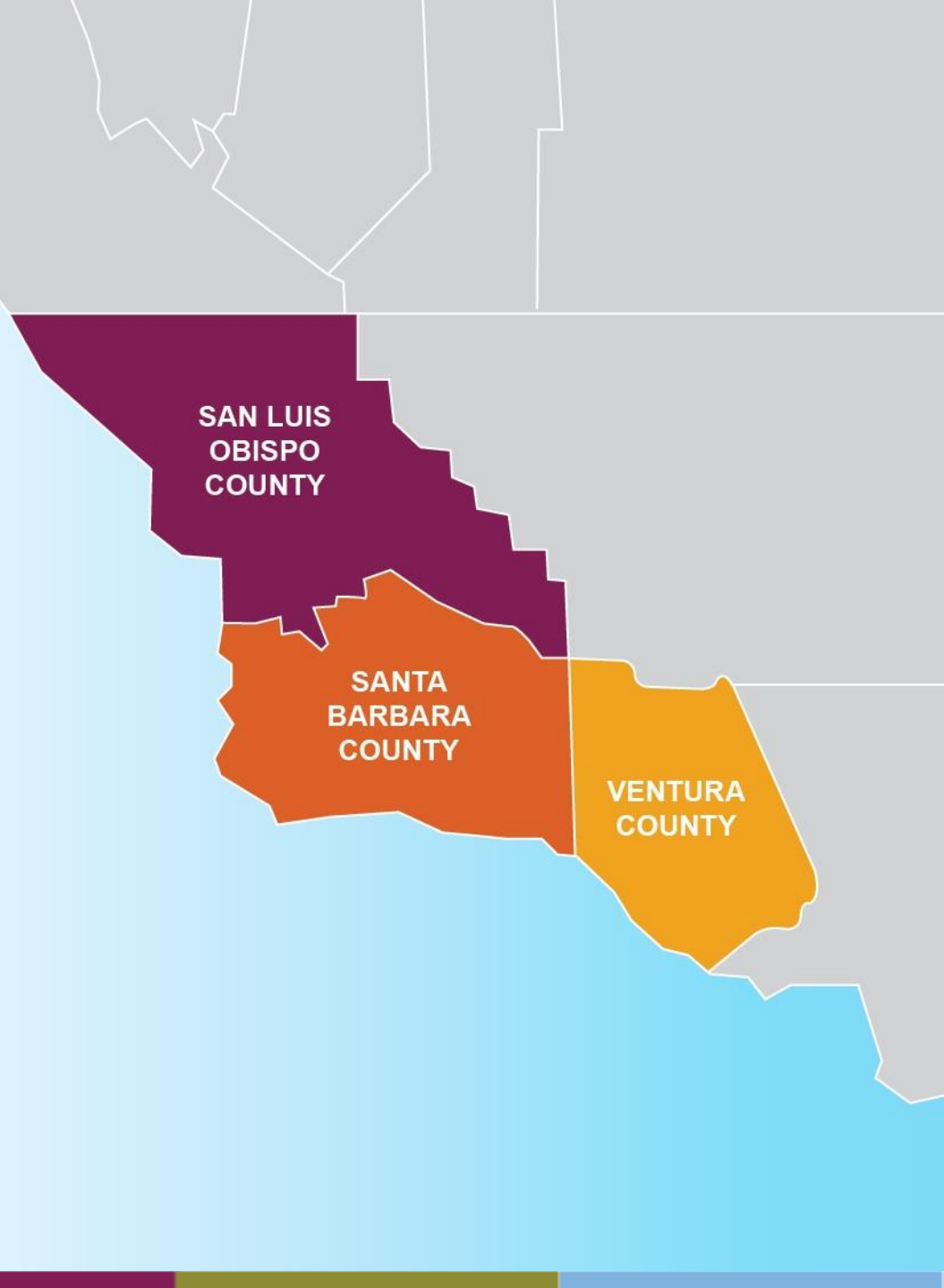
Zoom Orientation

- Please be sure your full name is displayed
- Please mute upon joining
- Use "Chat“ box to share questions or comments
- Under "Participant" select "Raise Hand" to share a question or comment verbally
- The session may be recorded and posted to 3C-REN's on-demand page. Feel free to ask questions via the chat and keep video off if you want to remain anonymous in the recording.



3C-REN: Tri-County Regional Energy Network

- Three counties working together to improve energy efficiency in the region
- Services for –
  - **Building Professionals:** industry events, training, and energy code compliance support
  - **Households:** free and discounted home upgrades
- Funded by ratepayer dollars that 3C-REN returns to the region



3C-REN
Staff Online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BUILDING
PERFORMANCE
TRAINING


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HOME
ENERGY
SAVINGS

3C
REN

3C REN ENERGY CODE CONNECT

- Serves all building professionals
- Three services –
  - **Energy Code Coach**
  - **Training and Support**
  - **Regional Forums**
- Makes the Energy Code easy to follow

Energy Code Coach:
3c-ren.org/codes
805.220.9991

Event Registration:
3c-ren.org/events

BUILDING PERFORMANCE TRAINING

- Serves current and prospective building professionals
- Expert instruction:
  - **Technical skills**
  - **Soft skills**
- Helps workers to thrive in an evolving industry

Event Registration:
3c-ren.org/events

3C REN HOME ENERGY SAVINGS

Multifamily (5+ units)

- No cost technical assistance
- Rebates up to $750/apartment plus additional rebates for specialty measures like heat pumps

Single Family (up to 4 units)

- Sign up to participate!
- Get paid for the metered energy savings of your customers

Enrollment:
3C-REN.org/contractor-participation

BAYREN

Local Governments Empowering Our Communities

2022 California Energy Standards: *Single Family Residential* Envelope Compliance

BayREN Codes & Standards

www.BayREN.org

Introduction

Today's Learning Objectives

- Understand the overall compliance process, including how **compliance forms** are used.
- Learn how to **prioritize your time** when plan checking and field inspecting residential envelope components.
- Understand the purpose and application of envelope and fenestration **performance values**.
- Be familiar with **best practices** for Energy Code Compliance.

Energy Code Requirements for Residential Envelopes

The Compliance Process

Before “diving into” the details of the energy code, it is first important to understand the overall process and how different people fit into it.

Energy Code Compliance Options

Mandatory Measures: Minimum requirements that must **always** be met

Prescriptive Path

- Usually a "prescribed" list of measures by CZ
- No design flexibility
- Common for alterations, changeouts, and smaller additions.

Pick One

Performance Path

- The energy performance of the "prescriptive package" is the target, but tradeoffs are allowed.
- Based on an energy simulation using State-approved software (CBECC, Energy Pro, etc.)
- Very common for new construction and larger additions.
- Rare for alterations, changeouts, etc.

“Prescriptive” Approach - Uses Table 150.1-A, B

TABLE 150.1-A COMPONENT PACKAGE – Single-Family Standard Building Design

Single-Family				Climate Zone														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope Insulation																			
Building Envelope	Roofs/Ceilings	Option B (meets § 150.1(c)9A)	Below Roof Deck Insulation[1,2] (With Air Space)	NR	NR	NR	R 19	NR	NR	NR	R 19	R 19	R 19	R 19	R 19	R 19	R 19	R 19	R 19
			Ceiling Insulation	R 38	R 38	R 30	R 38	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38	R 38
			Radiant Barrier	NR	REQ	REQ	NR	REQ	REQ	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR
		Option C (meets § 150.1(c)9B)	Ceiling Insulation	R 38	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 38	R 38	R 38	R 38	R 38	R 38
			Radiant Barrier	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
	Walls	Above Grade	Framed[3]	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.065	U 0.065	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 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.125 R 8.0	U 0.077 R 13
		Below Grade	Below Grade Interior[6]	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.067 R 15
			Below Grade Exterior[6]	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.200 R 5.0	U 0.100 R 10	U 0.100 R 10	U 0.053 R 19

Features vary by CZ

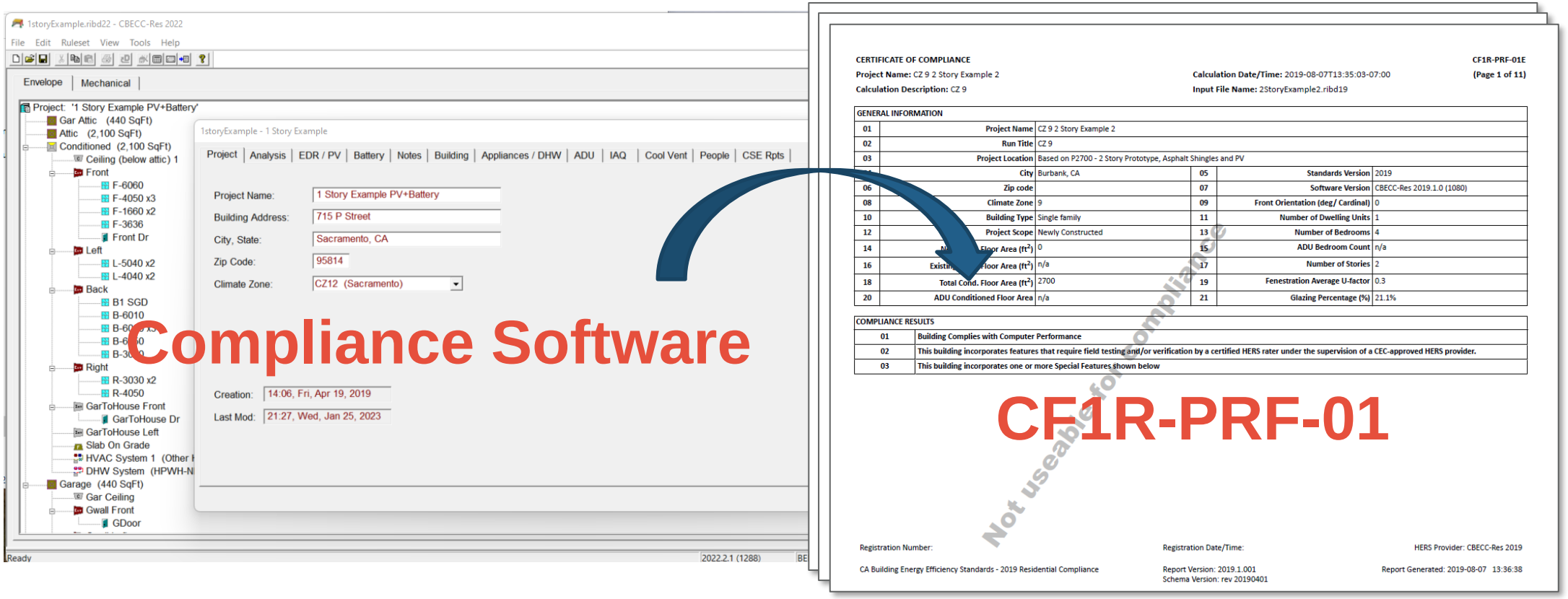
“Prescriptive” Approach - Uses Table 150.1-A, B

TABLE 150.1-A COMPONENT PACKAGE – Single-Family Standard Building Design (continued)

			Climate Zone															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Building Envelope	Floors	Slab Perimeter	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U-0.58 R-7.0
		Raised	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U-0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U- 0.037 R-19	U-0.037 R-19	U-0.037 R-19	U-0.037 R-19	U- 0.037 R-19
		Concrete Raised	U 0.092 R-8.0	U 0.092 R-8.0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.092 R-8.0	U 0.138 R-4.0	U 0.092 R-8.0	U 0.092 R-8.0	U 0.138 R-4.0	U 0.092 R-8.0
	Quality Insulation Installation (QII)		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Roofing Product	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
	Fenestration	Maximum U-factor		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
		Maximum SHGC		NR	0.23	NR	0.23	NR	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	NR
		Maximum Total Area		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
		Maximum West Facing Area		NR	5%	NR	5%	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	NR
	Door	Maximum U-factor		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

Features vary by CZ

“Performance” Approach Uses a Computer to Calculate Energy Use



After the house is made to comply in the software a file is uploaded to the HERS registry which creates the registered CF1R. It can also print an unregistered CF1R, like this one. Do not accept unregistered CF1Rs for new construction.

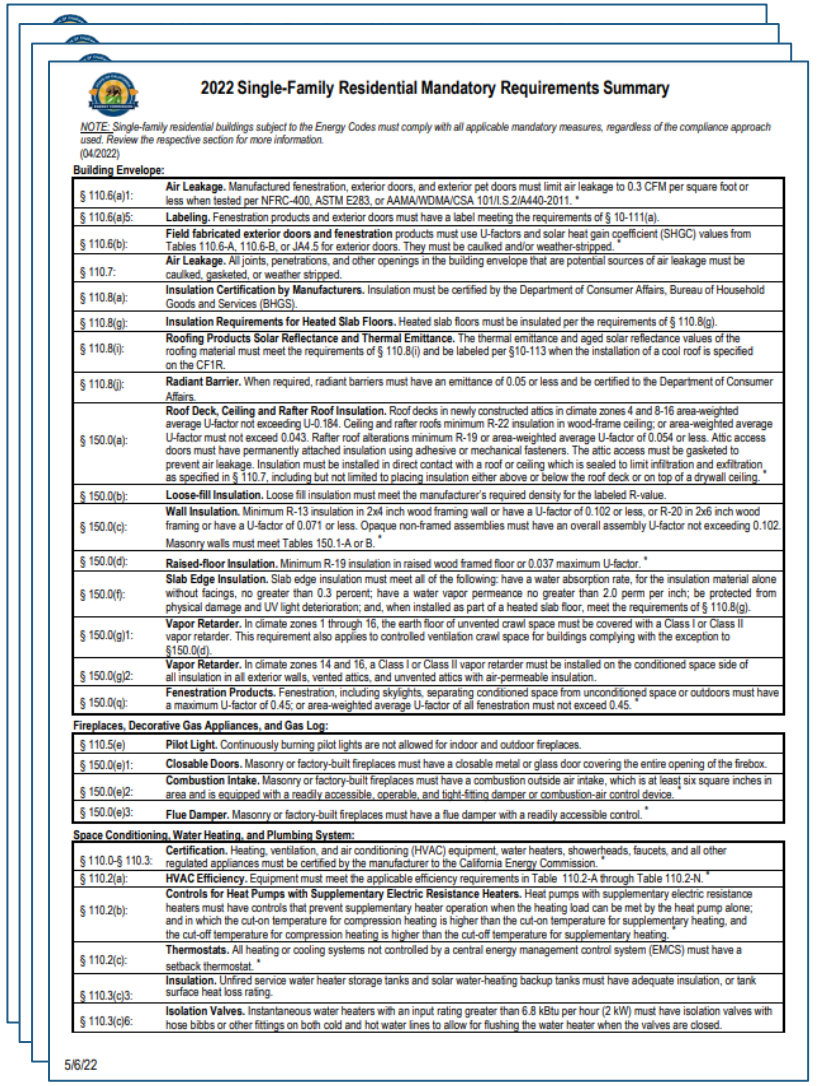
“Mandatory Measures” must always be met regardless of the approach

- Mandatory measures are shown on most of the CF2R forms and can be found in section 150.0.
- They include things like minimum efficiencies for equipment and required features or controls.
- They also set that absolute lowest you can go on some features that might be traded off in the performance method.

“Mandatory Measures” must always be met regardless of the approach

- Refer to handout:

  “2019 Low-Rise Residential Mandatory Measures Summary ”



2022 Single-Family Residential Mandatory Requirements Summary

NOTE: Single-family residential buildings subject to the Energy Codes must comply with all applicable mandatory measures, regardless of the compliance approach used. Review the respective section for more information.
(04/2022)

Building Envelope:

§ 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 101/I.S.2/A440-2011. *
§ 110.6(a)5:	**Labeling.** Fenestration products and exterior doors must have a label meeting the requirements of § 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 JA4.5 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 § 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 CF1R.
§ 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):	**Roof Deck, Ceiling and Rafter Roof Insulation.** Roof decks in newly constructed attics in climate zones 4 and 8-16 area-weighted average U-factor not exceeding U-0.184. Ceiling and rafter roofs minimum R-22 insulation in wood-frame ceiling; or area-weighted average U-factor must not exceed 0.043. Rafter roof alterations minimum R-19 or area-weighted average U-factor of 0.054 or less. 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 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. Opaque non-framed assemblies must have an overall assembly U-factor not exceeding 0.102. Masonry walls must meet Tables 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 percent; 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 of 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 0.45; or area-weighted average U-factor of all fenestration must not exceed 0.45. *

Fireplaces, Decorative Gas Appliances, and Gas Log:

§ 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:

§ 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 California Energy Commission. *
§ 110.2(a):	**HVAC Efficiency.** Equipment must meet the applicable efficiency requirements in Table 110.2-A through Table 110.2-N. *
§ 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)3:	**Insulation.** Unfired service water heater storage tanks and solar water-heating backup tanks must have adequate insulation, or tank surface heat loss rating.
§ 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.

5/6/22

“Mandatory Measures” must always be met regardless of the approach

- Refer to handout:

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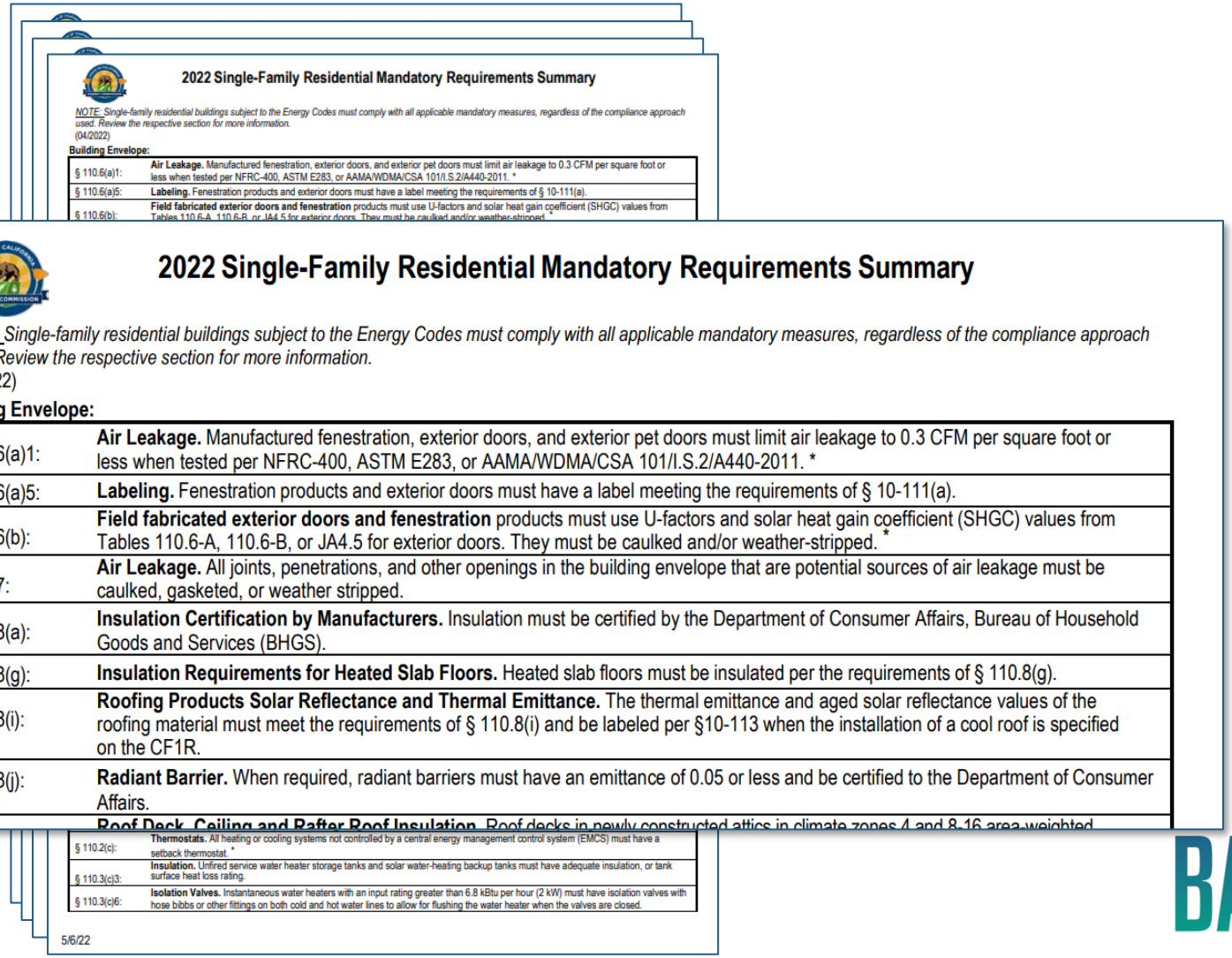

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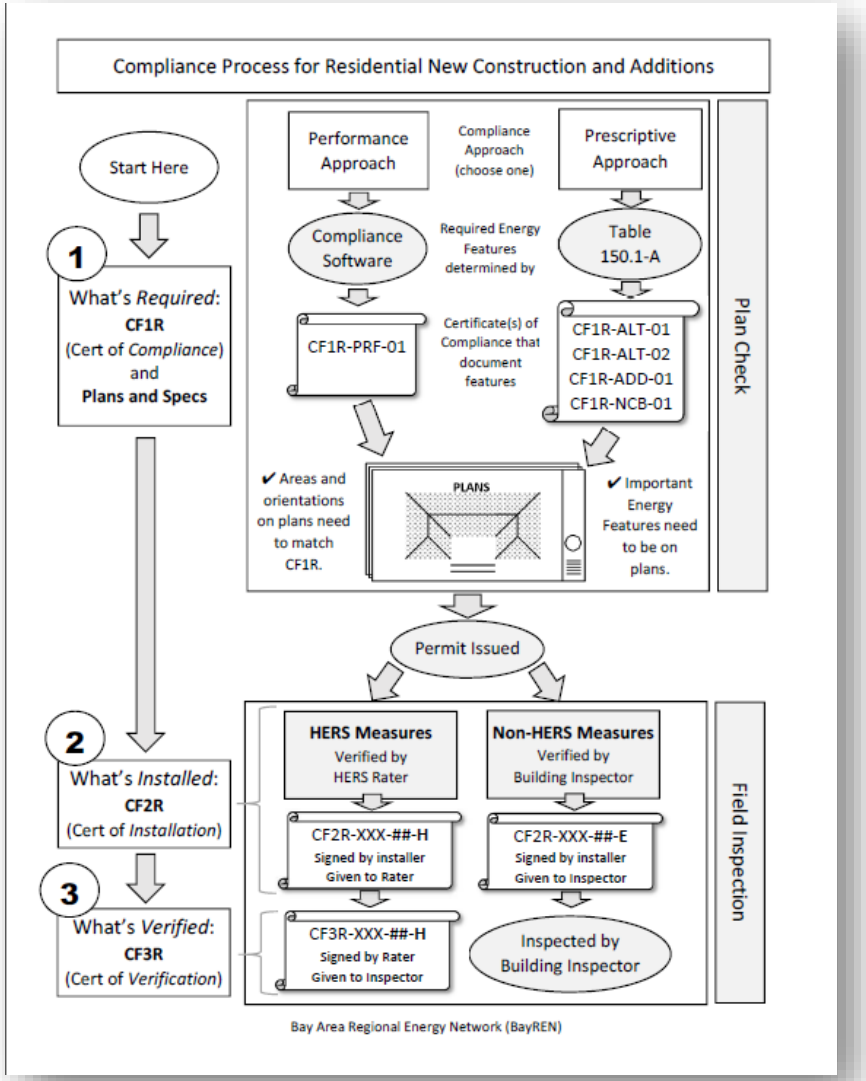
5/6/22

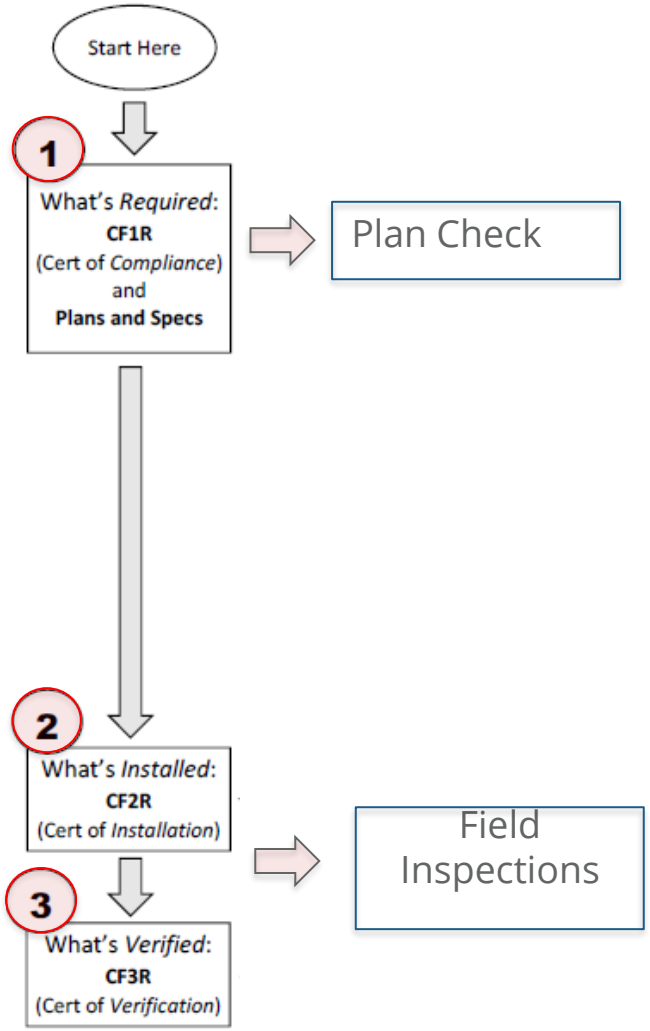
Compliance Process Flow Diagram

Refer to full-size copy provided with your handouts.



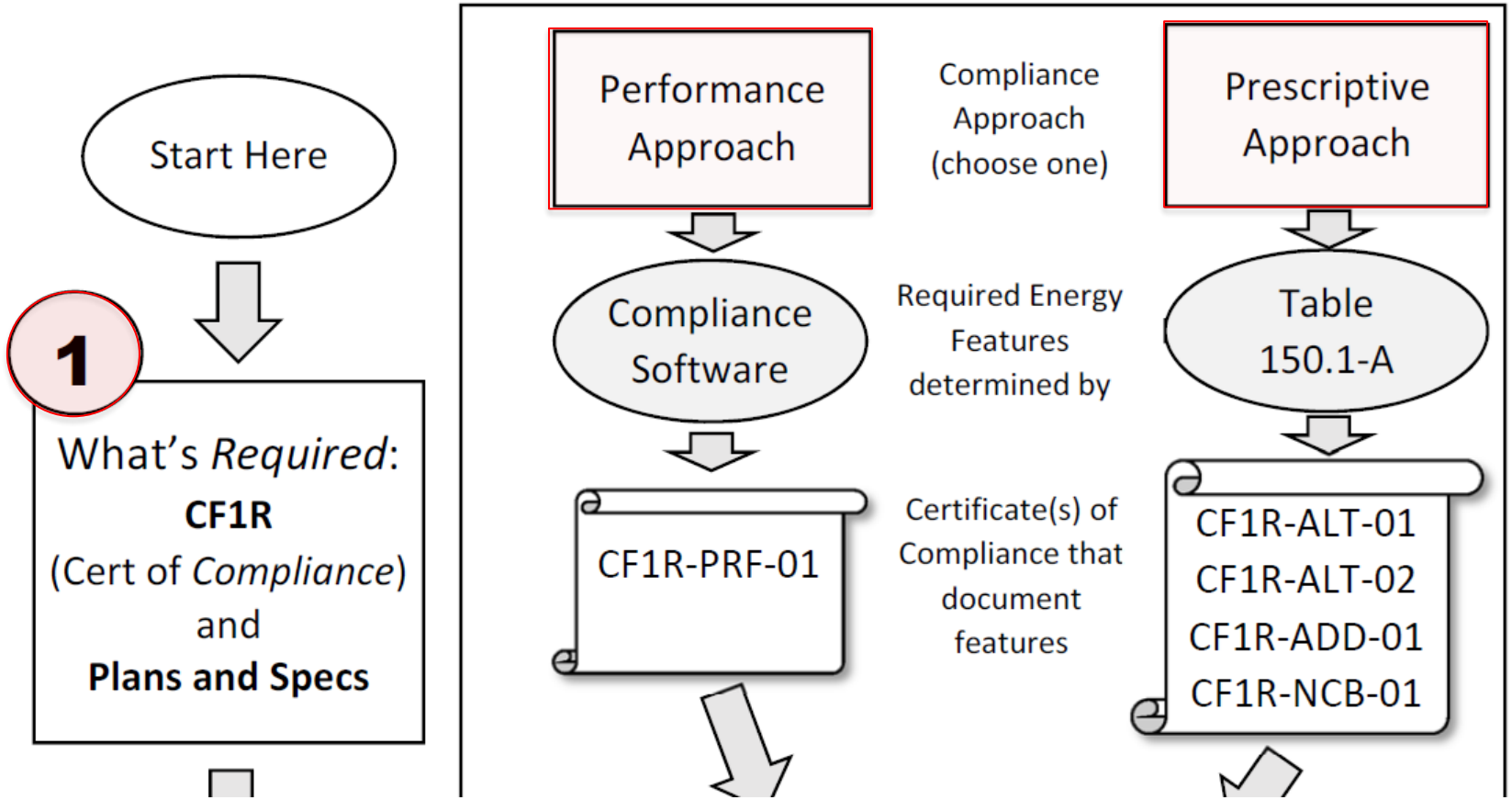
Compliance Process Flow Diagram

- Notice that the forms follow a simple 1 - 2 - 3 flow:
- CF1R ⇨ CF2R ⇨ CF3R
- Notice that process is divided into Plan Check and Field Inspection sections and that good communication must flow between them.
- The forms are intended to facilitate this.



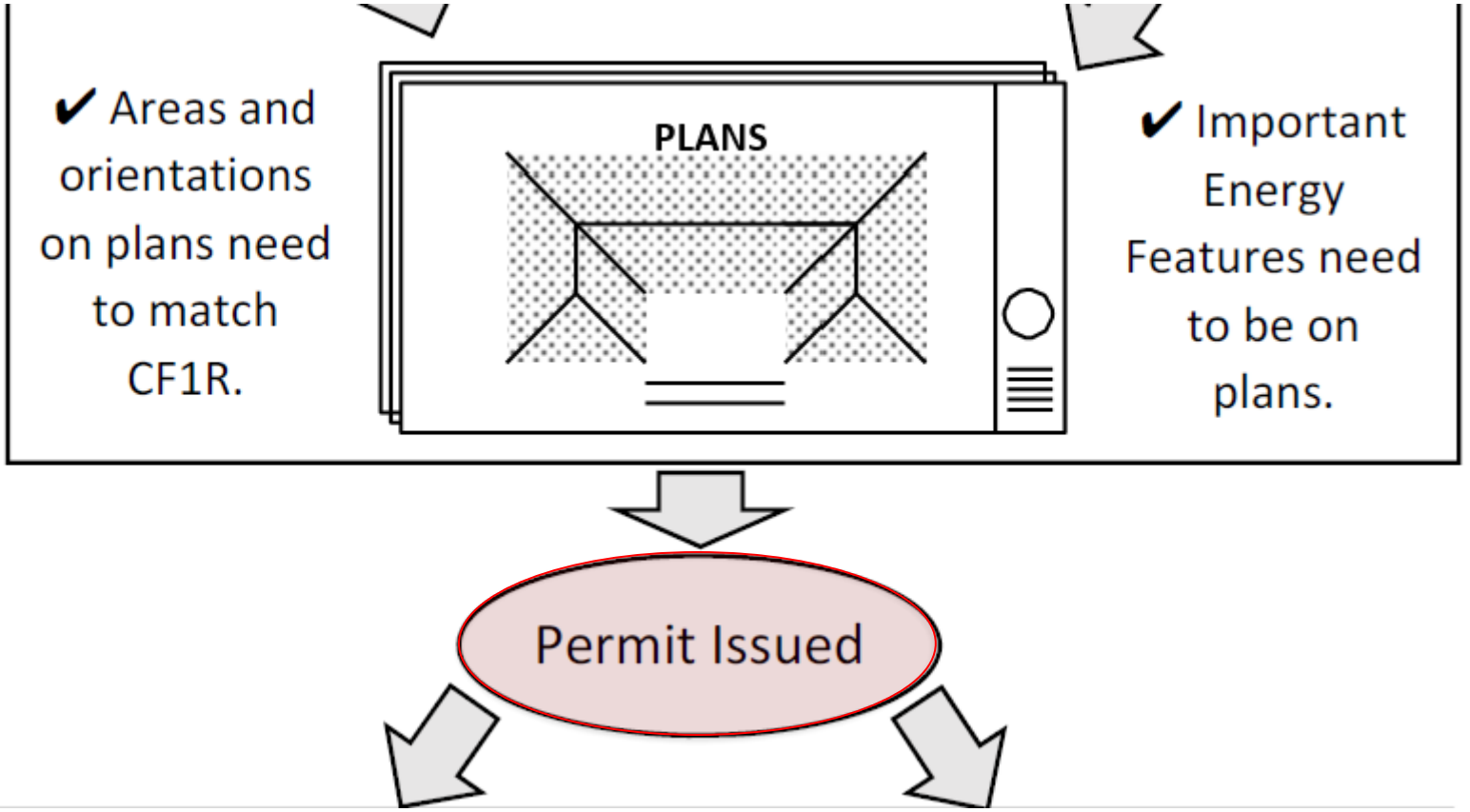
Compliance Process Flow Diagram

The document author determines which compliance approach is to be used and creates the compliance documents.



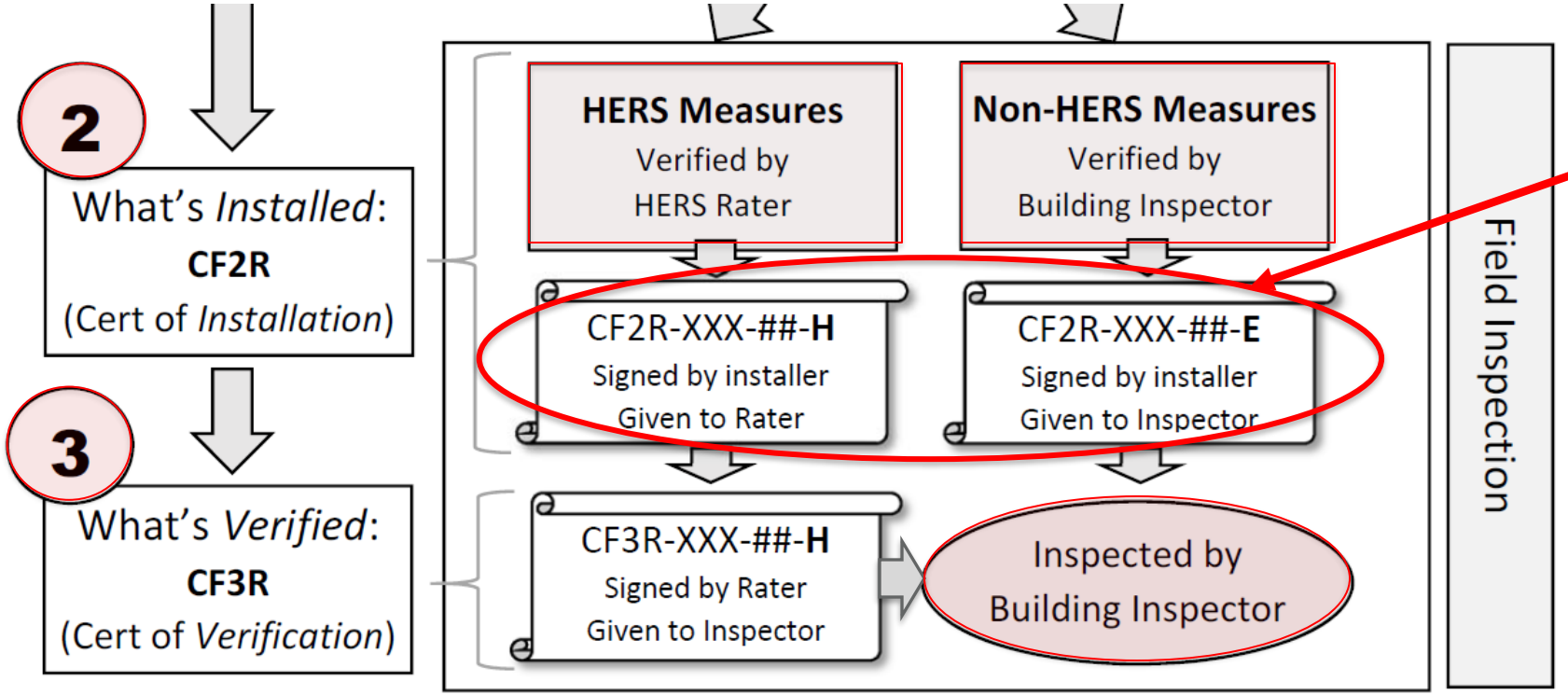
Compliance Process Flow Diagram

After the plans have been checked for accuracy and the compliance documents are verified to match, the permit is issued.



Compliance Process Flow Diagram

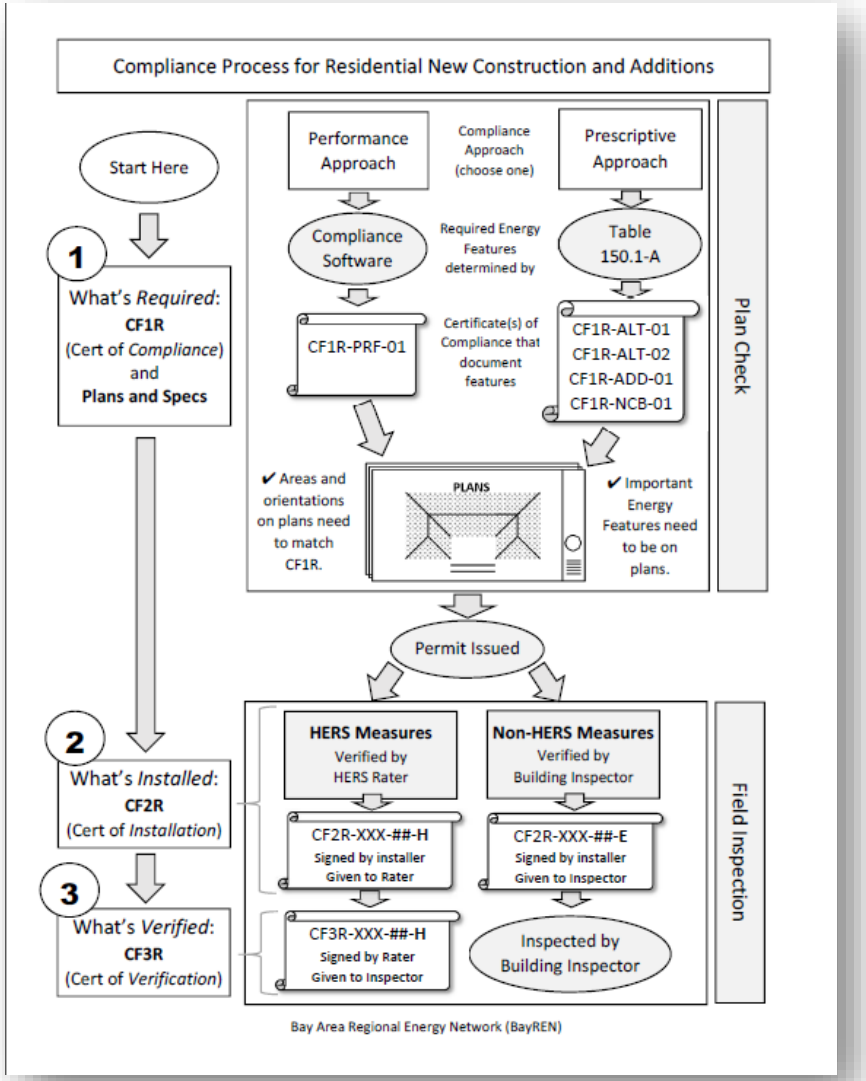
- The project starts and the energy features are installed.
- The responsible persons submit the supporting documents.
- The building inspector verifies that all documents have been submitted.



ALL measures (HERS and non-HERS) require a CF2R.

Compliance Process Flow Diagram

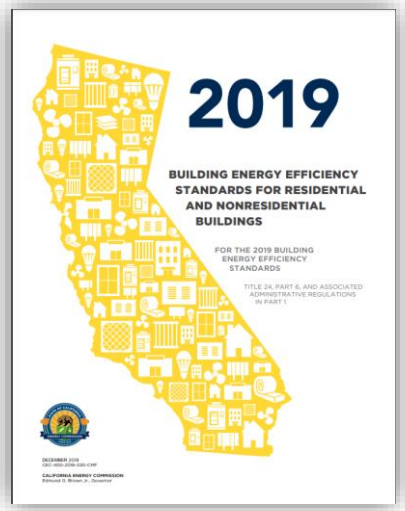
Any questions?



Energy Code Re-organization for 2022 Code

Multifamily Subchapters Added

T24 Part 6 Energy Code – Subchapter Organization



All [*regulated*] Occupancies

(A, B, E, F, H, I M, R, S, or U, except I-3 and I-4)

Subchapter 1 –All Occupancy –Scope, Definition
Subchapter 2 –All Occupancies – Mandatory Requirements

Sec 100.0-100.3 & Sec 110.0-110.12

Not Low-Rise Res

Subchapter 3 –Nonresidential, High-Rise Res, Hotel/Motel, Covered Process –Mandatory Requirements [*HVAC and Ventilation*]

Sec 120.0-120.9

Subchapter 4 –Nonresidential, High-Rise Res, Hotel/Motel – Mandatory Requirements [*Lighting and Power*]

Sec 130.0-130.5

Subchapter 5 –Performance and Prescriptive [*New Construction*]

Sec 140.0-140.9

Subchapter 6 – Additions and Alterations

Sec 141.0-141.1

Low-Rise Res

Subchapter 7 –Low-Rise Residential Mandatory Measures

Sec 150.0

Subchapter 8 – Performance and Prescriptive [*New Construction*]

Sec 150.1

Subchapter 9 –Additions and Alterations

Sec 150.2

T24 Part 6 Energy Code – Subchapter Organization

All [*regulated*] *Occupancies*

(A, B, E, F, H, I M, R, S, or U, except I-3 and I-4)

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Sec 120.0-120.9

Subchapter 4 –Nonresidential, Hotel/Motel –Mandatory Requirements [*Lighting and Power*]

Sec 130.0-130.5

Subchapter 5 –Performance and Prescriptive [*New Construction*]

Sec 140.0-140.9

Subchapter 6 – Additions and Alterations

Sec 141.0-141.1

Single Family Res

Subchapter 7 –Single Family Residential Mandatory Measures

Sec 150.0

Subchapter 8 –Performance and Prescriptive [*New Construction*]

Sec 150.1

Subchapter 9 –Additions and Alterations

Sec 150.2

Multifamily Res

Subchapter 10 –Multifamily Residential Mandatory Measures

Sec 160.0-160.9

Subchapter 11 –Performance and Prescriptive [*New Construction*]

Sec 170.0-170.2

Subchapter 12 –Additions and Alterations

Sec 180.0-180.4

Energy Design Ratings (EDR)

EDR1
Energy Source Design Rating
(New proxy for carbon)

EDR2 (TDV)
Energy Efficiency Design Rating + Solar Electric Generation and Demand Flexibility Design Rating

Source EDR

includes energy used by:

- Envelope
- IAQ
- HVAC
- DHW
- Unregulated loads

TDV Efficiency EDR

includes energy used by:

- Envelope
- IAQ
- HVAC
- DHW
- Unregulated loads

TDV Total EDR

includes energy used by:

- Efficiency EDR measures **plus**
- Solar PV
- Battery Storage
- Precooling

Performance Method (Computer Modeling)

Must meet ALL THREE to comply for new construction:

- **Source EDR** (**EDRs**) Represents the building energy efficiency in terms of an hourly source as **proxy for carbon-based metric**
- **Efficiency EDR (EDRe)** Represents the building energy efficiency in terms of a TDV energy based metric
- **Total EDR (EDRt**) Represents both the Energy Efficiency Design Rating and the Solar Electric Generation and Demand Flexibility Design Rating.

Key Take-aways for 2022

Source EDR
New proxy for carbon

Compliance software has changes to the **Standard Design** which now **varies by climate zone** and includes either **heat pump space or water heating**

Definition

Single Family in the Energy Code:

- A townhouse
- Residential building Occupancy R-3 with 2 or fewer dwelling units
- Building of occupancy R- 3 other than MF or hotel/motel
- Building of Occupancy 3.1
- Building with Occupancy U on residential site

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

- R-2, multifamily, with three habitable stories or less; or
- R-3, single family; or
- U-building, located on a residential site.

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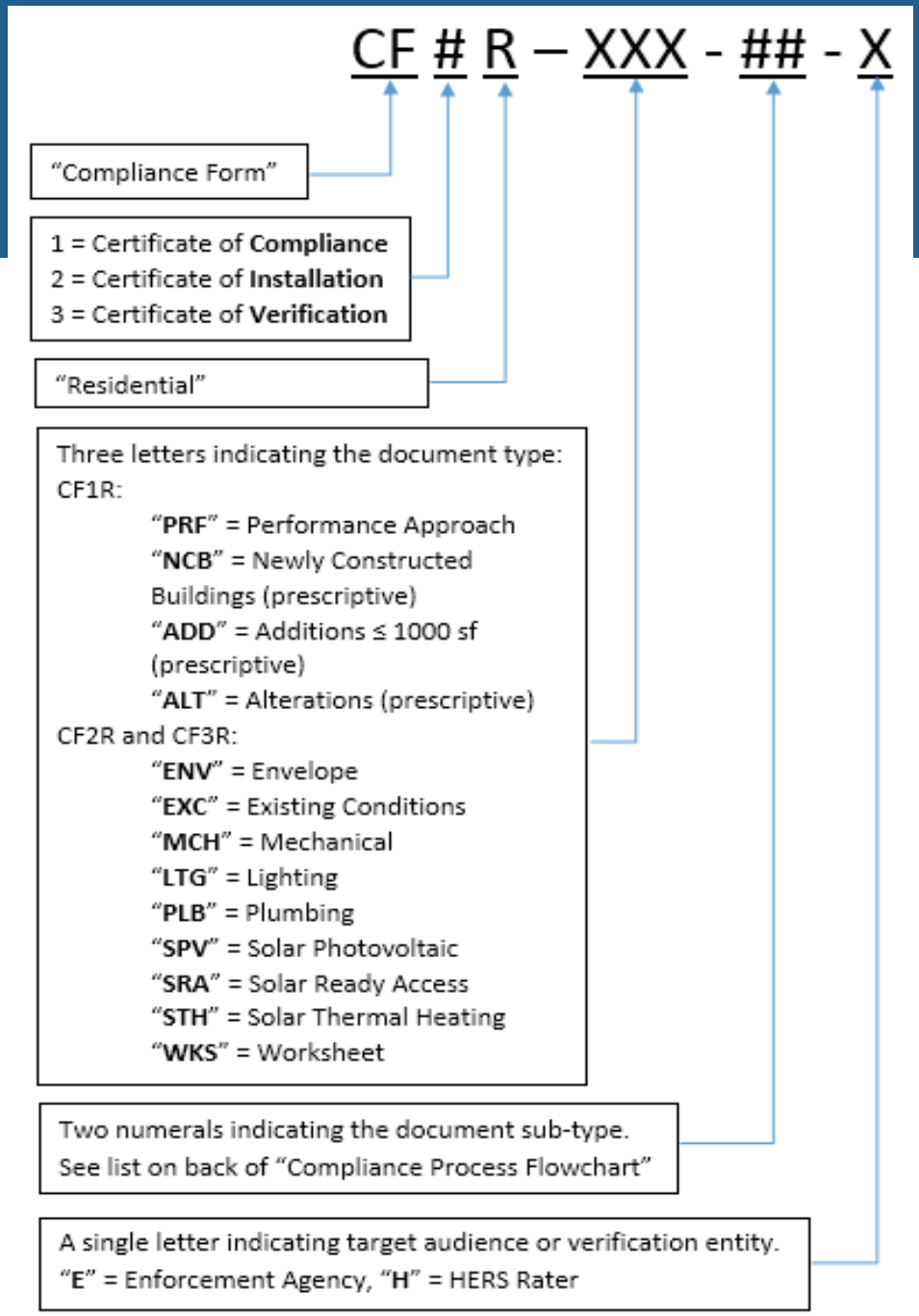
Energy Code Compliance Documents

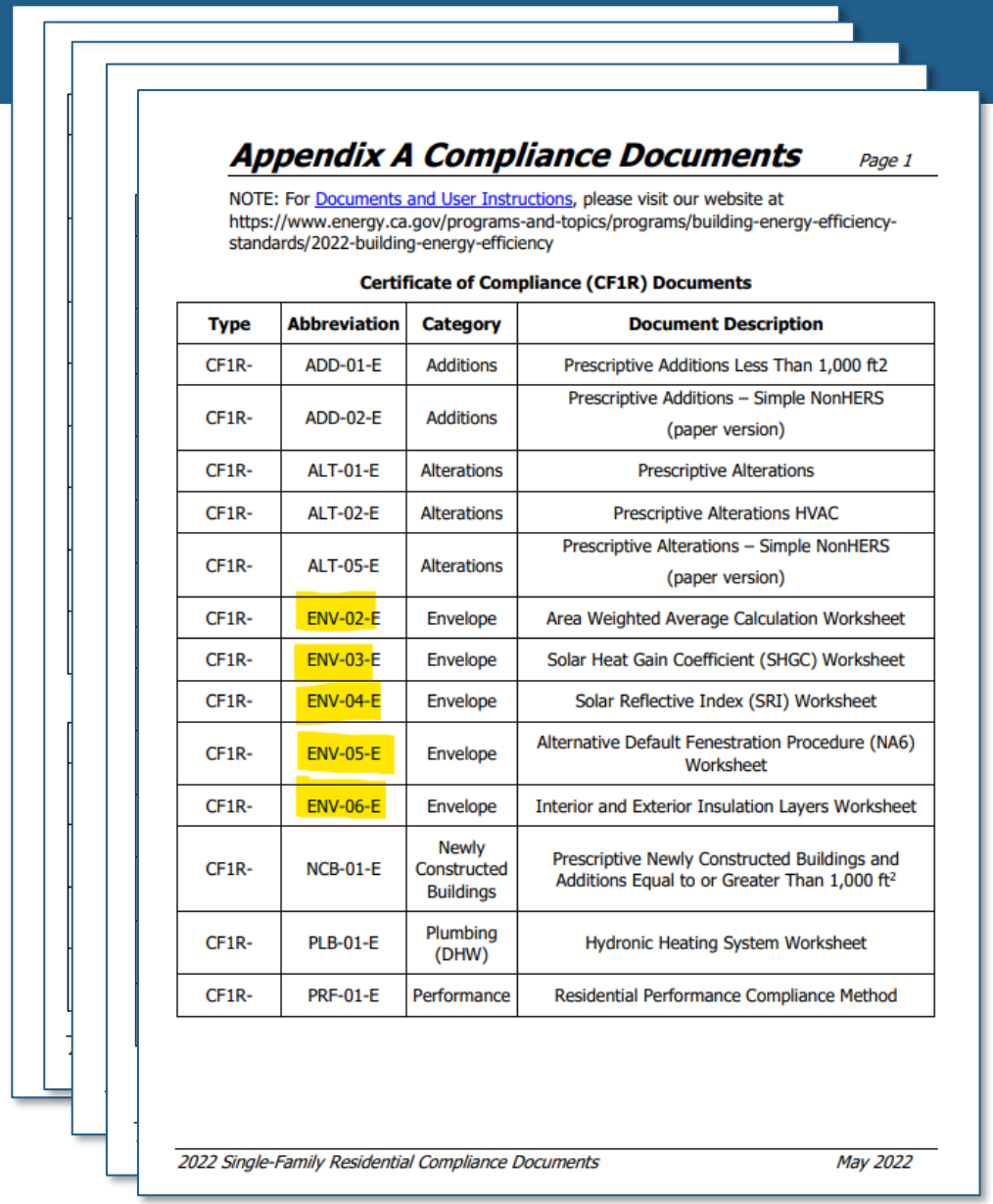
Naming Convention



Compliance Documents List

There are LOTS of compliance documents: CF1Rs, CF2Rs, and CF3Rs.

The good news is that, thanks to the HERS Registries, most of them are all electronic.



Appendix A Compliance Documents

Page 1

NOTE: For Documents and User Instructions, please visit our website at https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency

Certificate of Compliance (CF1R) Documents

Type	Abbreviation	Category	Document Description
CF1R-	ADD-01-E	Additions	Prescriptive Additions Less Than 1,000 ft2
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 ft²
CF1R-	PLB-01-E	Plumbing (DHW)	Hydronic Heating System Worksheet
CF1R-	PRF-01-E	Performance	Residential Performance Compliance Method

2022 Single-Family Residential Compliance Documents *May 2022*

2022 Residential Compliance Manual

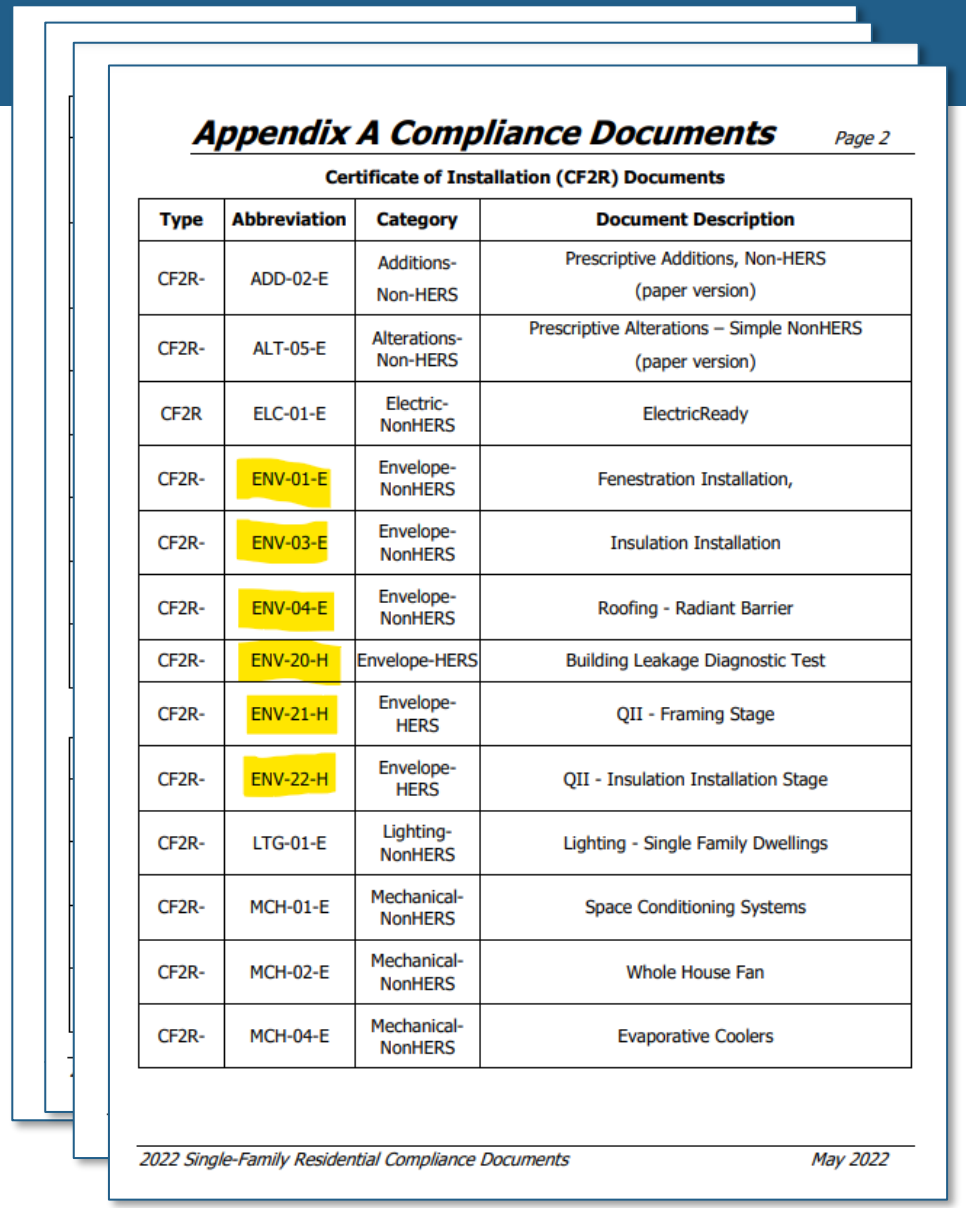
Appendix A
Table of Contents

CF1R-ENV
Only used for prescriptive approach (rare)

Compliance Documents List

There are LOTS of compliance documents: CF1Rs, CF2Rs, and CF3Rs.

The good news is that, thanks to the HERS Registries, most of them are all electronic.



Appendix A Compliance Documents *Page 2*

Certificate of Installation (CF2R) Documents

Type	Abbreviation	Category	Document Description
CF2R-	ADD-02-E	Additions-Non-HERS	Prescriptive Additions, Non-HERS (paper version)
CF2R-	ALT-05-E	Alterations-Non-HERS	Prescriptive Alterations – Simple NonHERS (paper version)
CF2R	ELC-01-E	Electric-NonHERS	ElectricReady
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-	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

2022 Single-Family Residential Compliance Documents *May 2022*

2022 Residential Compliance Manual

Appendix A
Table of Contents

CF2R-ENV
Used frequently in new construction, additions and alterations

Compliance Documents List

There are LOTS of compliance documents: CF1Rs, CF2Rs, and CF3Rs.

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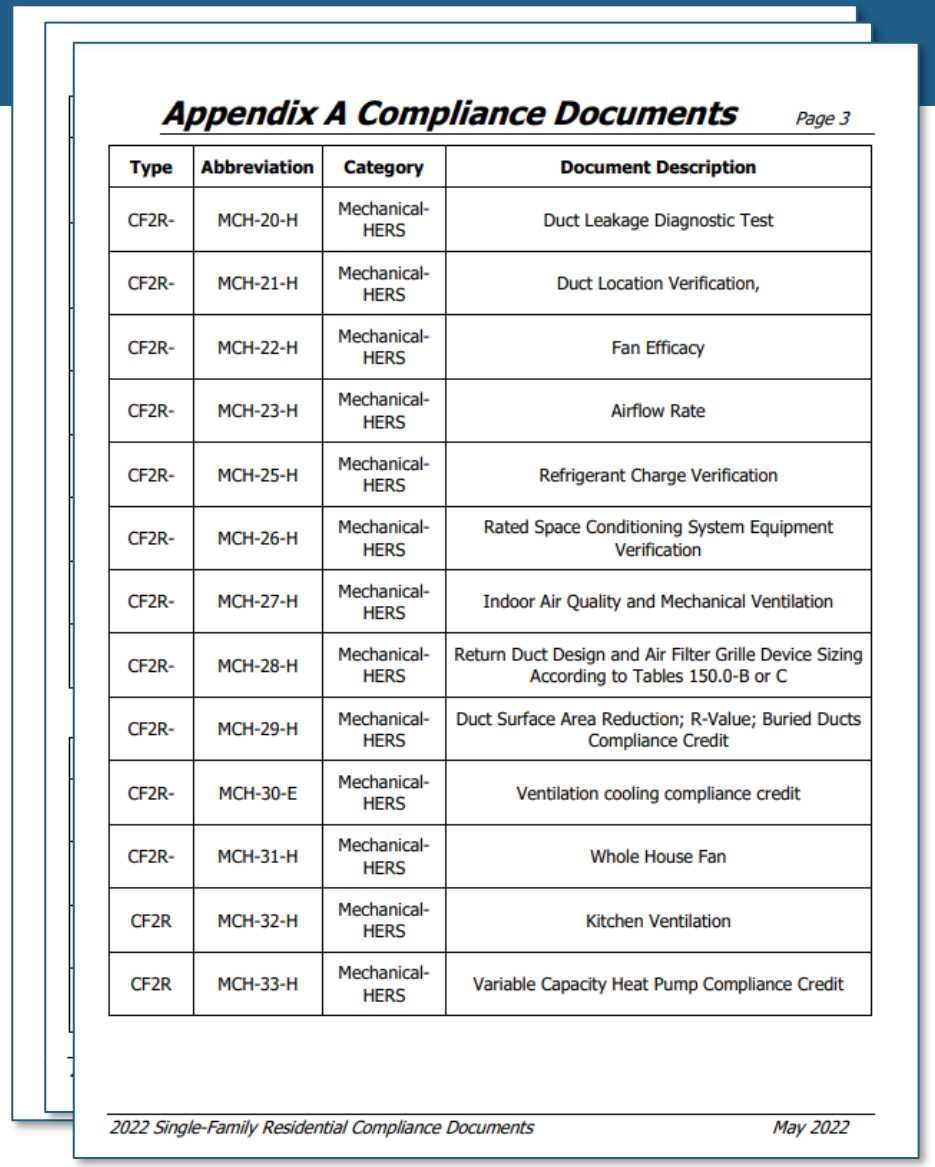

Appendix A Compliance Documents *Page 3*

Type	Abbreviation	Category	Document Description
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-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	Whole House Fan
CF2R	MCH-32-H	Mechanical-HERS	Kitchen Ventilation
CF2R	MCH-33-H	Mechanical-HERS	Variable Capacity Heat Pump Compliance Credit

2022 Single-Family Residential Compliance Documents *May 2022*

2022 Residential Compliance Manual

Appendix A
Table of Contents

Compliance Documents List

There are LOTS of compliance documents: CF1Rs, CF2Rs, and CF3Rs.

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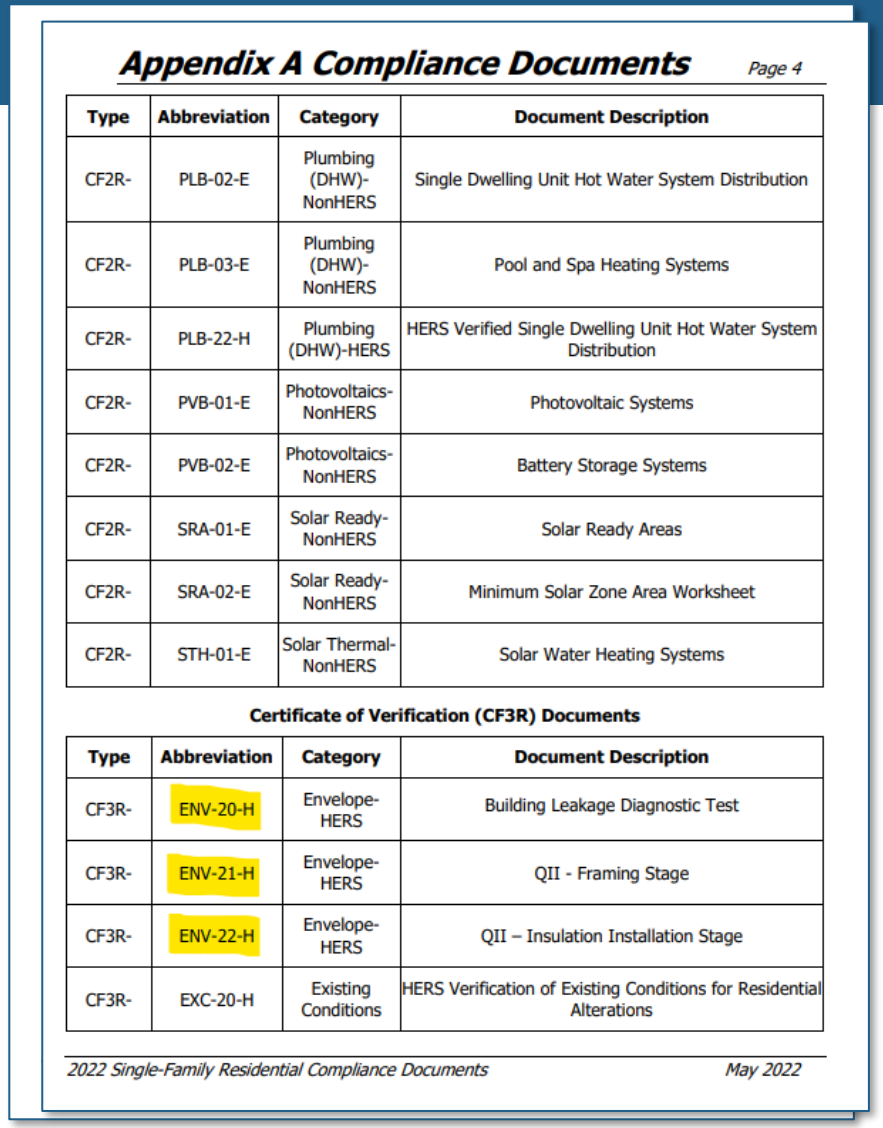

Appendix A Compliance Documents Page 4

Type	Abbreviation	Category	Document Description
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-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-NonHERS	Solar Ready Areas
CF2R-	SRA-02-E	Solar Ready-NonHERS	Minimum Solar Zone Area Worksheet
CF2R-	STH-01-E	Solar Thermal-NonHERS	Solar Water Heating Systems

Certificate of Verification (CF3R) Documents

Type	Abbreviation	Category	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

2022 Single-Family Residential Compliance Documents *May 2022*

2022 Residential Compliance Manual

Appendix A
Table of Contents

CF3R-ENV forms Used for HERS verification (whenever a CF2R-ENV-XX-H is used)

Compliance Documents List

There are LOTS of compliance documents: CF1Rs, CF2Rs, and CF3Rs.

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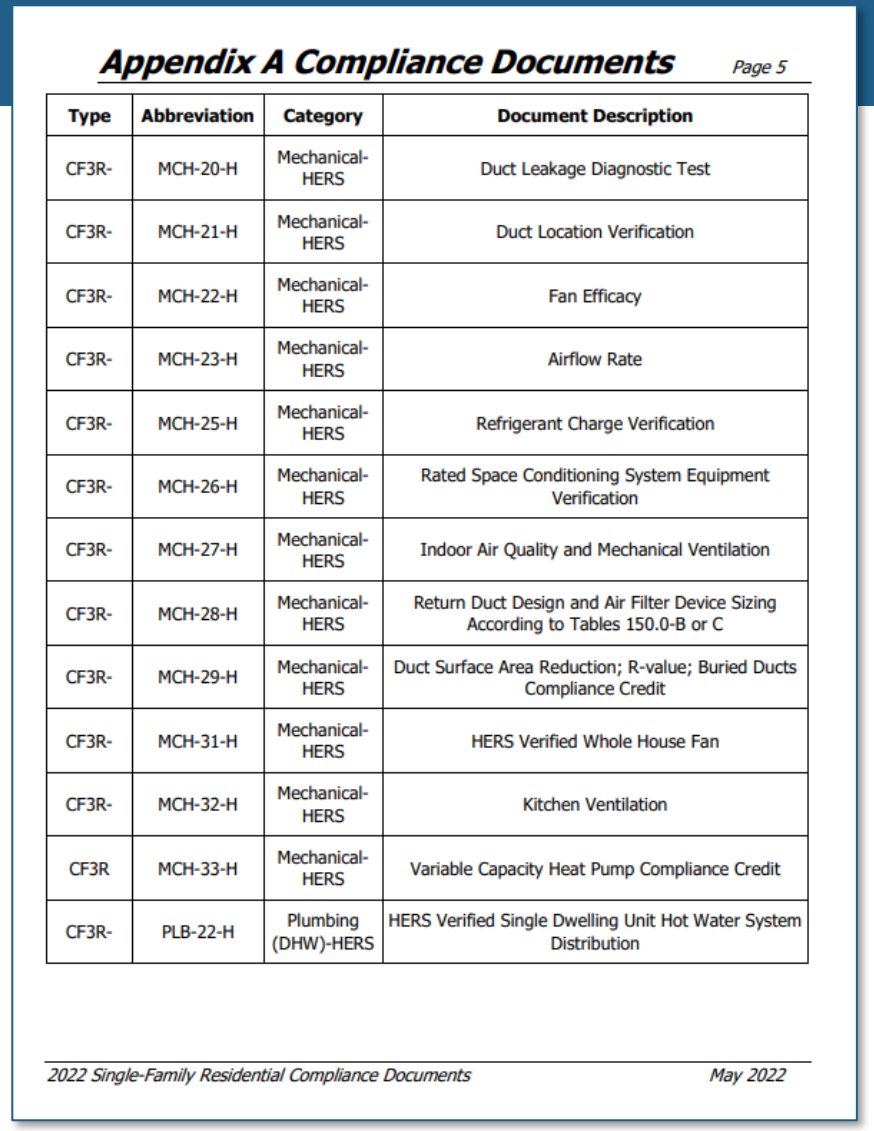


Appendix A Compliance Documents *Page 5*

Type	Abbreviation	Category	Document Description
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-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-32-H	Mechanical-HERS	Kitchen Ventilation
CF3R	MCH-33-H	Mechanical-HERS	Variable Capacity Heat Pump Compliance Credit
CF3R-	PLB-22-H	Plumbing (DHW)-HERS	HERS Verified Single Dwelling Unit Hot Water System Distribution

2022 Single-Family Residential Compliance Documents *May 2022*

2022 Residential Compliance Manual

Appendix A
Table of Contents

Registered vs. Non-registered Forms

- If the project has *at least one HERS measure*, the project will have to be *registered* with a HERS Provider. (All new construction and most additions)
- The CF2R and CF3R forms will then be generated and tracked by the HERS Registry.
- The Project Status Report will tell you which forms are needed for each registered project.

HERS Registries Can Track Documentation

- HERS registries are online tools that can help keep track of the forms for most projects
- The two CA HERS Providers with CEC approved registries are
  - CalCERTS, Inc. (www.calcerts.com)
  - CHEERS (www.cheers.org)

Forms That Will Commonly Be Used for *Envelope Measures*

CF1R – Certificates of Compliance: List what is required to comply with Energy Code.

- **CF1R-PRF-01-E**: Used when the ***performance*** approach is used to demonstrate compliance for any kind of project (software generated). Most new construction, some additions
- **CF1R-NCB-01-E:** Used when the ***prescriptive*** approach is used to demonstrate compliance for newly constructed homes and additions over 1,000 square feet. (Very rare – these projects almost always use the performance approach)
- **CF1R-ADD-01/02-E (HERS/Non-HERS):** Used when the ***prescriptive*** approach is used to demonstrate compliance for additions less than or equal to 1,000 square feet. Smaller, simpler additions
- **CF1R-ALT-01/05 (HERS/Non-HERS):** Used to demonstrate ***prescriptive*** compliance for non-HVAC alterations (roof, windows, walls, etc.).

Not used for envelope measures: **CF1R-ALT-02:** Used to demonstrate ***prescriptive*** compliance only for HVAC alterations.

Forms That Will Commonly Be Used for *Envelope Measures*

CF-2R – Certificates of Installation – Document what was *installed*.

Non-HERS Measures (-E)

- CF2R-ENV-01-E: Fenestration (windows, skylights, etc.)
- CF2R-ENV-03-E: Insulation specifications
- CF2R-ENV-04-E: Roofing products and radiant barrier

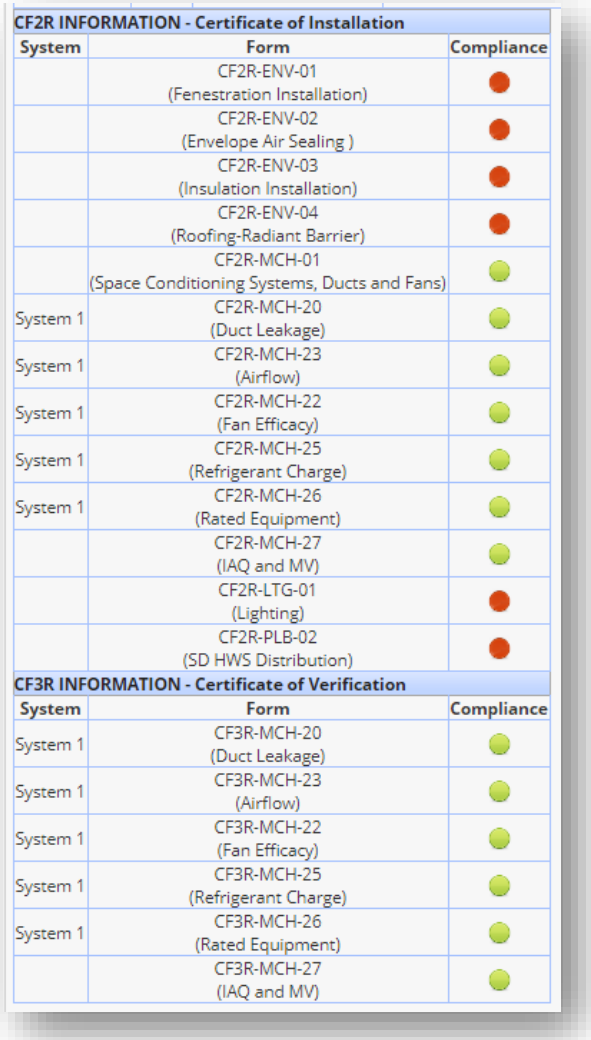
HERS Measures (-H)

- CF2R-ENV-20-H: Envelope air leakage (blower door test)
- CF2R-ENV-21-H: QII Framing Stage
- CF2R-ENV-22-H: QII Insulation Stage

Forms That Will Commonly Be Used for *Envelope Measures*

CF-3R – Certificates of Verification:
Document HERS Verification

- For each CF2R-XXX-##-**H** there is a corresponding CF3R, Certificate of Verification
- The HERS Registry will help you make sure the correct CF2Rs and CF3Rs get used and completed.



CF2R INFORMATION - Certificate of Installation		
System	Form	Compliance
	CF2R-ENV-01 (Fenestration Installation)	
	CF2R-ENV-02 (Envelope Air Sealing)	
	CF2R-ENV-03 (Insulation Installation)	
	CF2R-ENV-04 (Roofing-Radiant Barrier)	
	CF2R-MCH-01 (Space Conditioning Systems, Ducts and Fans)	
System 1	CF2R-MCH-20 (Duct Leakage)	
System 1	CF2R-MCH-23 (Airflow)	
System 1	CF2R-MCH-22 (Fan Efficacy)	
System 1	CF2R-MCH-25 (Refrigerant Charge)	
System 1	CF2R-MCH-26 (Rated Equipment)	
	CF2R-MCH-27 (IAQ and MV)	
	CF2R-LTG-01 (Lighting)	
	CF2R-PLB-02 (SD HWS Distribution)	
CF3R INFORMATION - Certificate of Verification		
System	Form	Compliance
System 1	CF3R-MCH-20 (Duct Leakage)	
System 1	CF3R-MCH-23 (Airflow)	
System 1	CF3R-MCH-22 (Fan Efficacy)	
System 1	CF3R-MCH-25 (Refrigerant Charge)	
System 1	CF3R-MCH-26 (Rated Equipment)	
	CF3R-MCH-27 (IAQ and MV)	

Source: CalCERTS® Quick Status Report

Envelope Assembly Performance Values

Building Assembly Performance Values

Important performance values for building assemblies are:

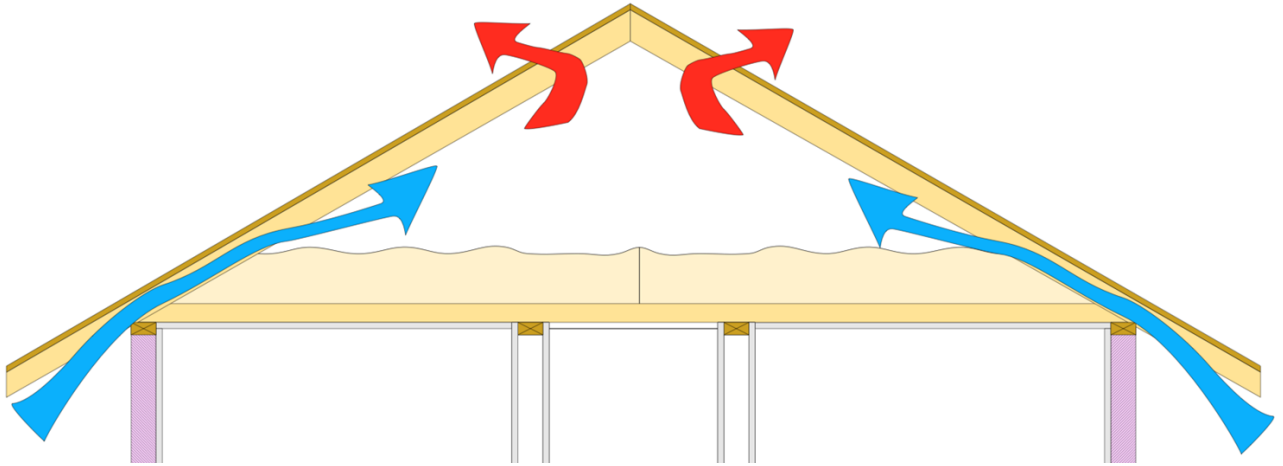
- All opaque surfaces
  - R-value (higher is better)
  - U-factor (**lower** is better)
- Roofs only
  - Solar Reflectance (higher is better)
  - Thermal Emittance (higher is better)

R-value and U-factor

- **R-value** is usually used to describe an *insulating material*.
  - A **higher** number means **less** heat transfer.
  - When verifying R-value against compliance documentation, the listed value is a **minimum**. “Higher is Better”.
- **U-factor** is usually used to describe an *assembly of materials*.
  - A **higher** number means **more** heat transfer.
  - When verifying U-factor against compliance documentation, the listed value is a **Maximum**. “Lower is Better”.

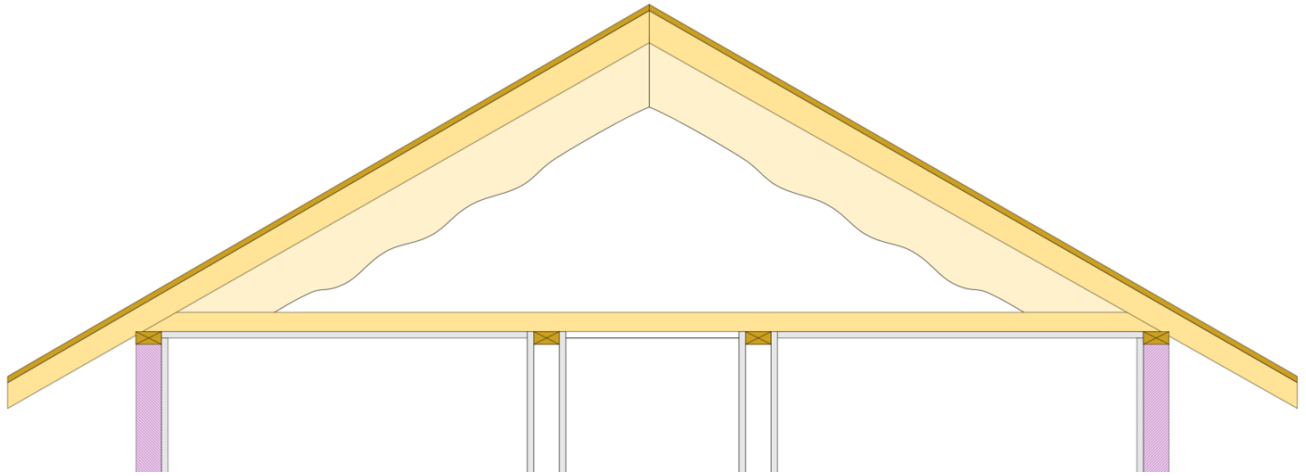
High Performance Attics

- Historically, most attics ***vented***. This means that vents are provided to allow unconditioned outside air to pass through the attic. (1:150 or 1:300 rules)
- The thermal boundary is at the ceiling of the house.



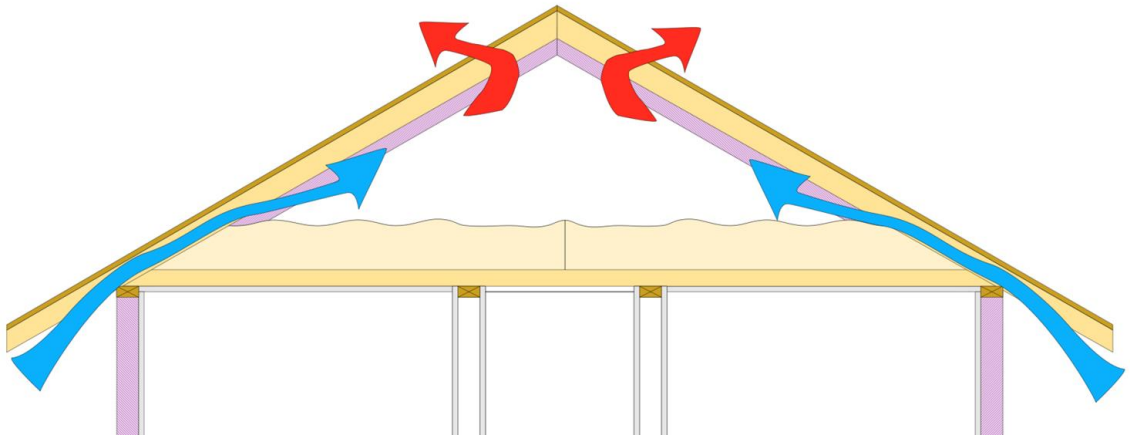
High Performance Attics

- Recently, ***unvented*** attics have become more popular due to a somewhat large energy compliance credit given by the compliance software for having the HVAC ducts inside semi-conditioned space.
- The thermal boundary is at the roof deck not the ceiling.



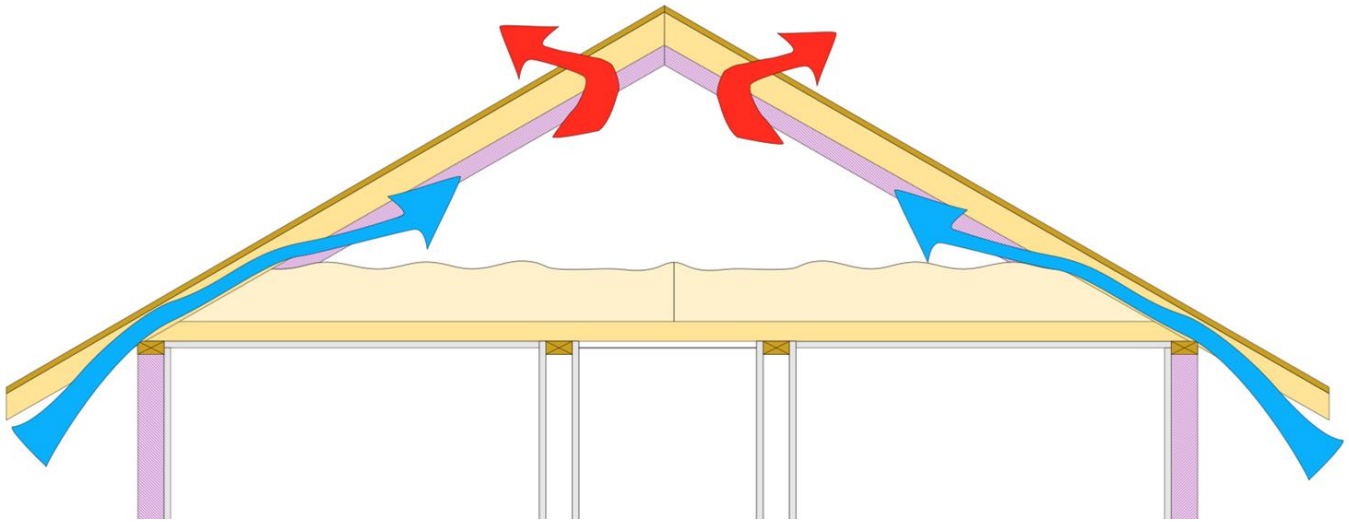
High Performance Attics

- Another type of ***vented*** attic is the "High Performance Attic (HPA)".
- This is where both the attic floor (ceiling of the house) and the attic ceiling (roof of the house) are insulated.



High Performance Attics

- Note that the attic is still vented.
- The purpose of the insulation at the roof is to prevent heat from coming into the vented attic, much like radiant barrier – but better.
- It also helps in the winter.



High Performance Attics

- This leaves **four** basic approaches to attics
  1. Vented
     A. Insulated at ceiling only (traditional attic)
     B. Insulated at ceiling and roof deck (HPA)
  2. Unvented
     A. Unfinished (indirectly conditioned)
     B. Finished (directly conditioned - rare)

BAYREN

Solar Reflectance and Thermal Emittance for Cool Roofs

- New Cool Roof technology has improved the roofing materials ability to reflect and emit heat energy without affecting the color of the roof.
- This is especially important in cooling dominated climates.

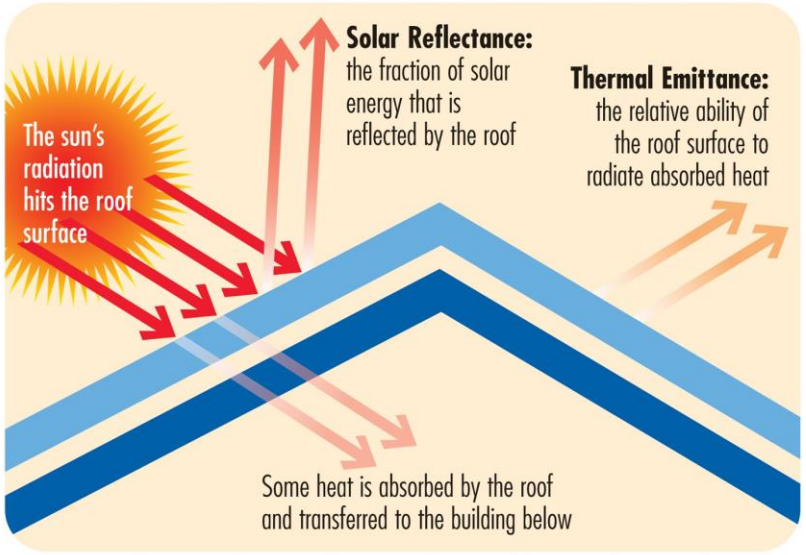
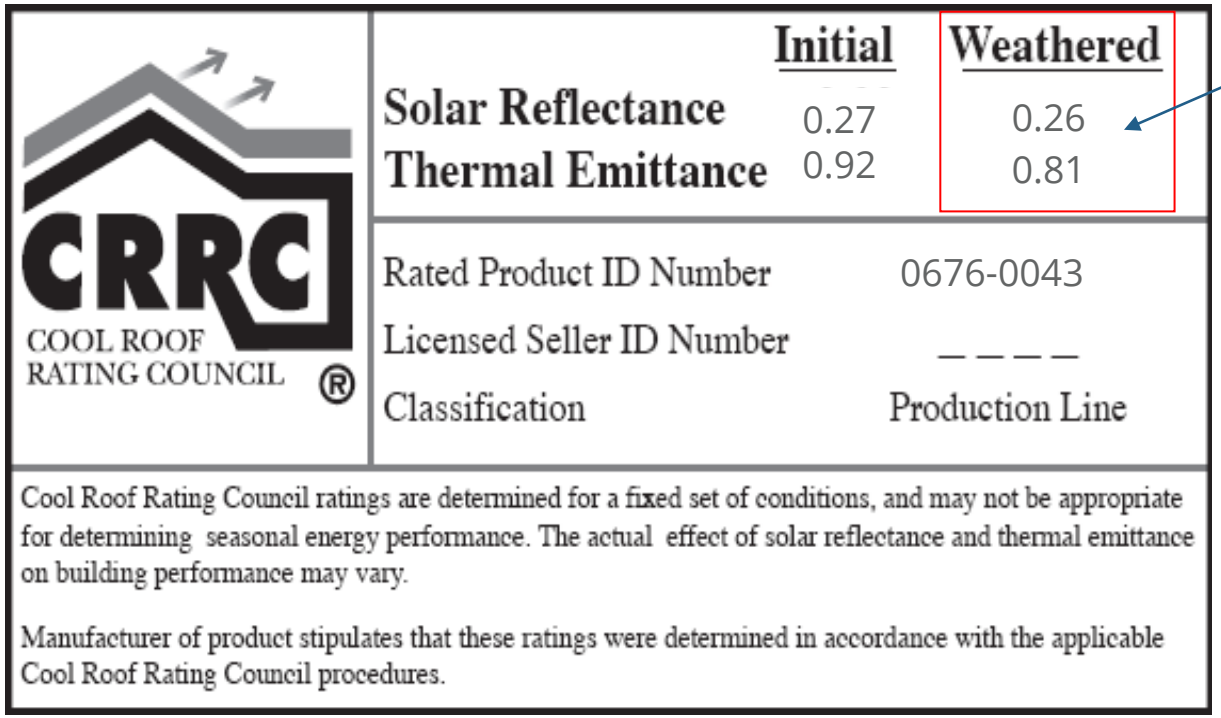


Diagram from coolroofs.org:

Solar Reflectance and Thermal Emittance for Cool Roofs

This is the CRRC label that indicates a roofing product's Solar Reflectance and Thermal Emittance.



Compliance Issue:
When verifying these values against compliance documentation, the listed value is a **minimum**. "Higher is Better".

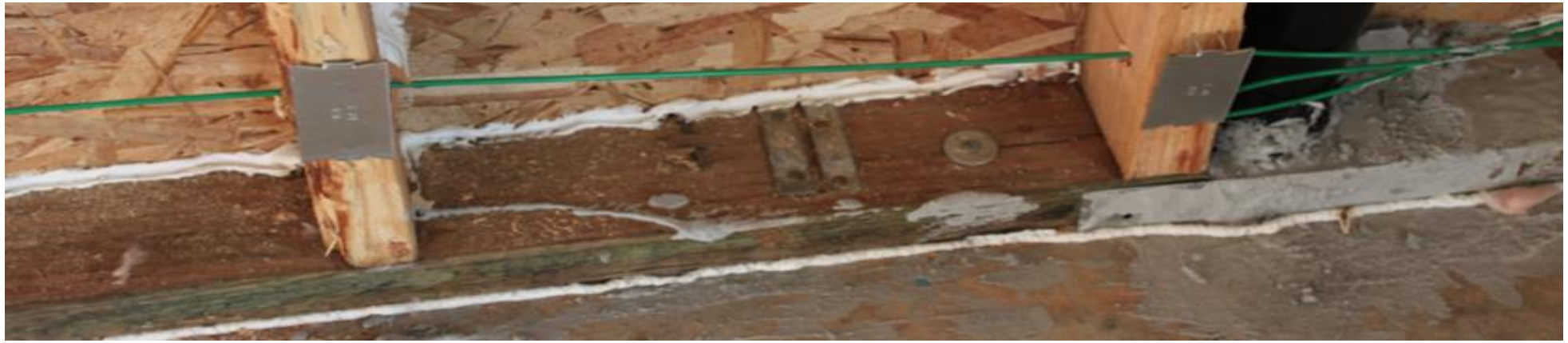
Overview of Mandatory and Prescriptive Envelope Requirements (All in the Checklist)

Joints and Other Openings – Mandatory Measures

- Air leakage through joints, penetrations, cracks, holes and openings around windows, doors, walls, roofs and floors can result in higher energy use for home heating and cooling than necessary.

Joints and Other Openings – Mandatory Measures

- The following openings in the building envelope shall be caulked, gasketed, weather-stripped or otherwise sealed:
  - Exterior joints around window and door frames, including doors between the house and garage, between interior HVAC closets and conditioned space, between attic access and conditioned space, between wall sole plates and the floor, exterior panels and all siding materials.



Joints and Other Openings – Mandatory Measures

Openings in exterior walls, ceilings and floors for plumbing, electricity, and gas lines.

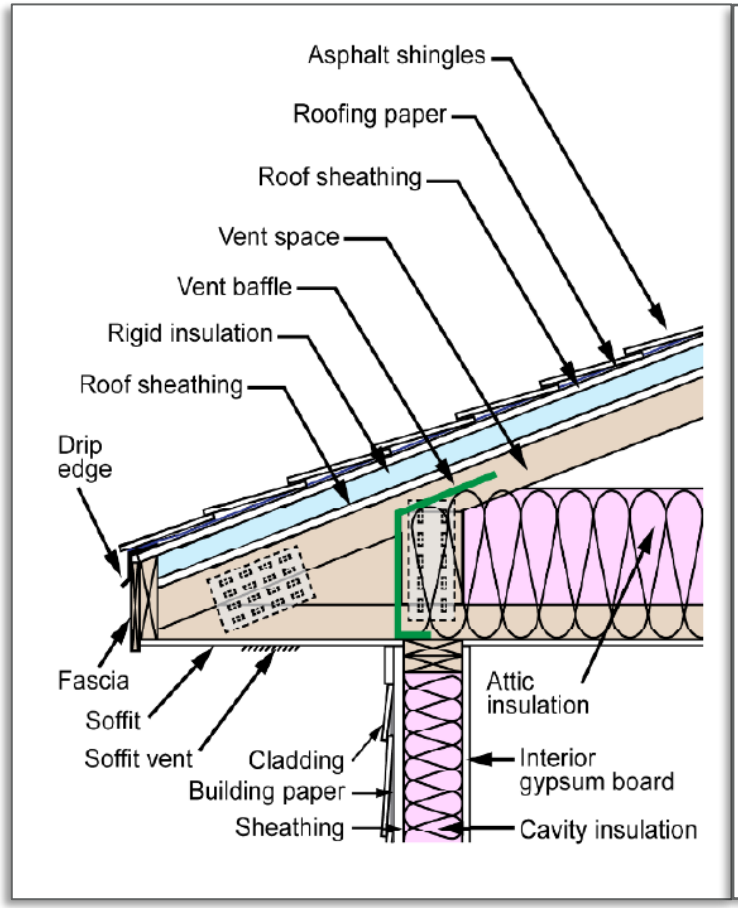
Openings in the attic floor (such as where ceiling panels meet interior and exterior walls and masonry fireplaces).

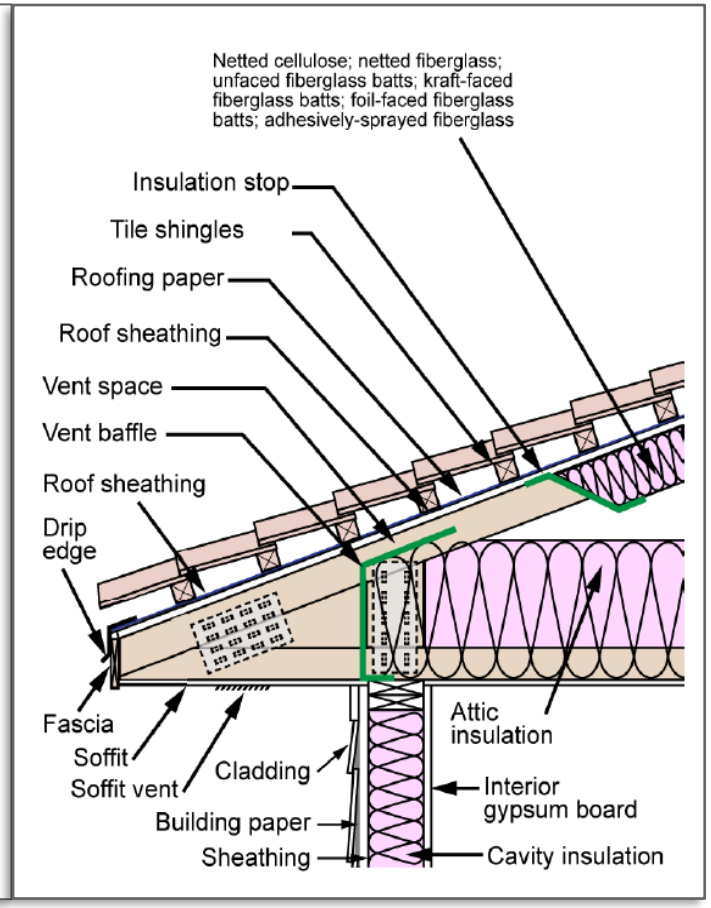
Roof Deck in Newly Constructed Attic Systems

Applies to CZ 4 and 8-16:

- **New** Insulation either above or below the roof deck or a combination of the two
- Weighted average U-factor of roof deck cannot exceed 0.184 (Example, R-5 exterior continuous insulation)
- Exceptions when duct system is located within the conditioned space, i.e. below insulated ceiling

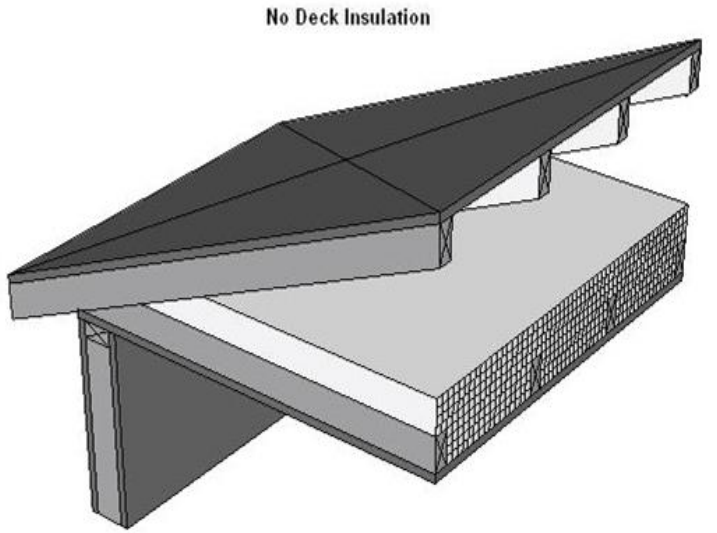
Image credit: CEC





Roof/Ceiling – Mandatory Measures

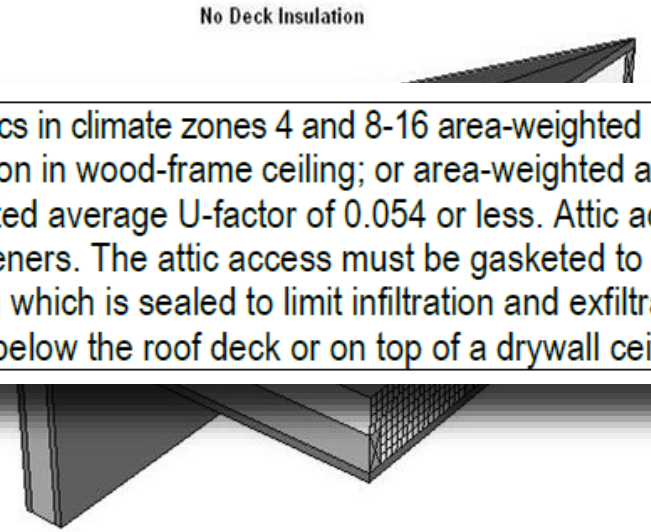
- Wood framed roof/ceiling construction assemblies must have at least R-22 insulation or a maximum U-factor of 0.043
  - See Section G of CF2R-ENV-03-E
- Some areas of the roof/ceiling can be less than the mandatory minimum U-factor as long as other areas exceed the requirement and the weighted average U-factor for the overall ceiling/roof meets the requirement.



Roof/Ceiling – Mandatory Measures

- Wood framed roof/ceiling construction assemblies must have at least R-22 insulation or a maximum

§ 150.0(a):	**Roof Deck, Ceiling and Rafter Roof Insulation.** Roof decks in newly constructed attics in climate zones 4 and 8-16 area-weighted average U-factor not exceeding U-0.184. Ceiling and rafter roofs minimum R-22 insulation in wood-frame ceiling; or area-weighted average U-factor must not exceed 0.043. Rafter roof alterations minimum R-19 or area-weighted average U-factor of 0.054 or less. 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 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. *

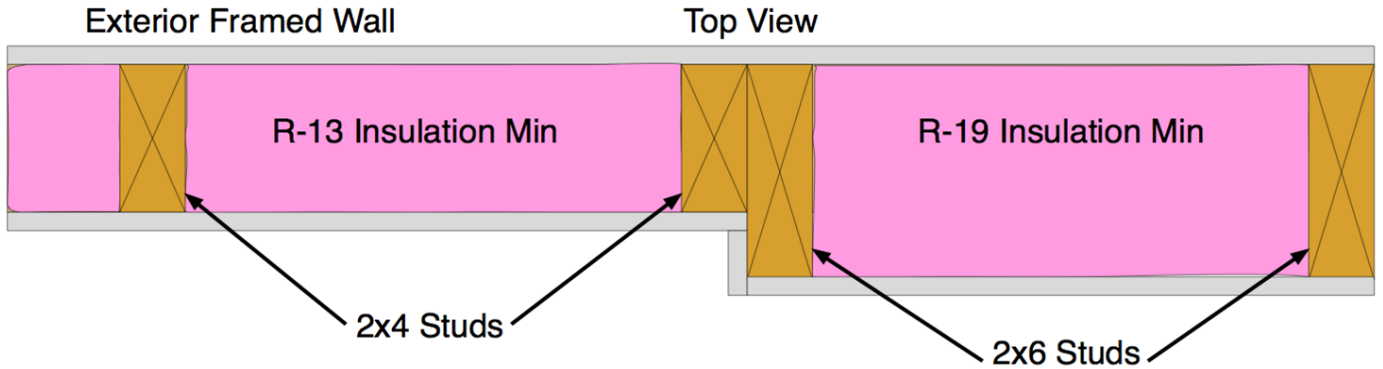


less than the mandatory minimum U-factor as long as other areas exceed the requirement and the weighted average U-factor for the overall ceiling/roof meets the requirement.

Walls - Mandatory Measures

See Section G of CF2R-ENV-03-E

- The mandatory measures have two requirements depending on frame size:
  - 2x4 inch wood-framed walls above grade shall have at least R-13 insulation installed in the cavities between framing members, or a *weighted average* U-factor that cannot exceed U-0.102.
  - 2x6 inch or greater wood-framed walls above grade shall have at least R-20 insulation installed in the cavities between framing members or a *weighted average* U-factor not exceeding 0.074



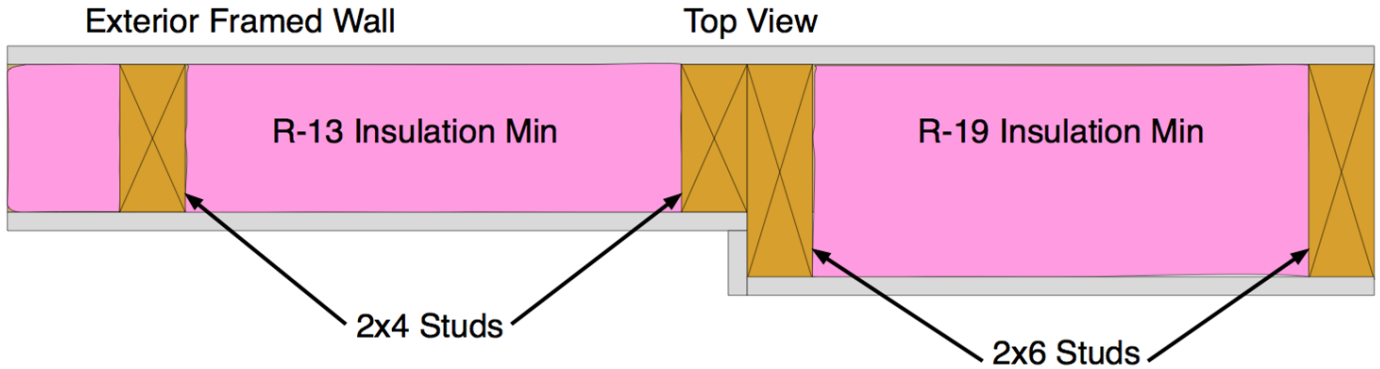
Walls - Mandatory Measures

See Section G of CF2R-ENV-03-E

- The mandatory measures have two requirements depending on frame size:
  - 2x4 inch wood-framed walls above grade shall have at least R-13 insulation installed in the cavities between framing members, or a

§ 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. Opaque non-framed assemblies must have an overall assembly U-factor not exceeding 0.102. Masonry walls must meet Tables 150.1-A or B. *

weighted average U-factor not exceeding 0.074



Prescriptive Measures

- Note that the prescriptive requirements assume “high performance attics” with insulation at the ceiling AND roof deck.
- Remember that the prescriptive packages are mostly used to establish the target energy budget. (on the ***Standard*** house the ***Proposed*** house is being compared to)
- Prescriptive measures can be traded off against other features or extra credits.

Additions –Roof and Ceiling

Additions that are **700 square feet or less** shall meet the requirements of Section 150.1(c) [i.e. Prescriptive Components], with the following modifications:

Roof and ceiling insulation in a ventilated attic shall meet one of the following requirements:

a. In **Climate Zones 1, 2, 4, and 8 - 16**, achieve an overall assembly U-factor not exceeding 0.025. In wood framed assemblies, **R-38** or greater.

b. In **Climate Zones 3, 5, 6, and 7**, achieve an overall assembly U-factor not exceeding 0.031. In wood framed assemblies, **R-30** or greater.

Change from 2019 Code: CZ's 2, 4, 8, 9 and 10 got "upgraded" to R-38

BAYREN

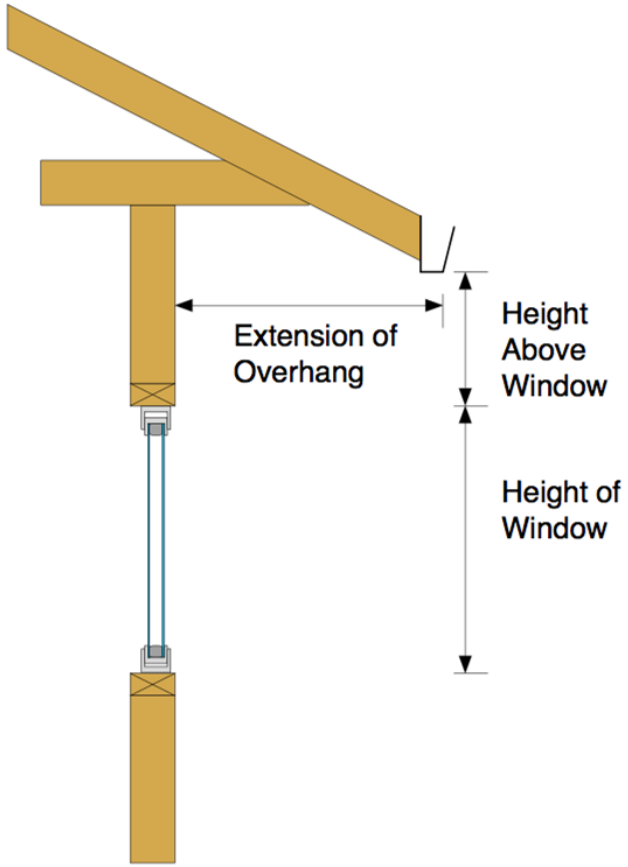
Fenestration Performance Values and Impacts

NFRC Labels

Image from Residential Compliance Manual.

- To be installed in a home in CA, manufactured windows must be tested and rated by the National Fenestration Rating Council (NFRC).
- They also provide both temporary and permanent labels that can be affixed to each window.
- Only representative sizes of each type of window are tested.
- Testing every size of every model would be too burdensome and the variations between sizes would be relatively minor.

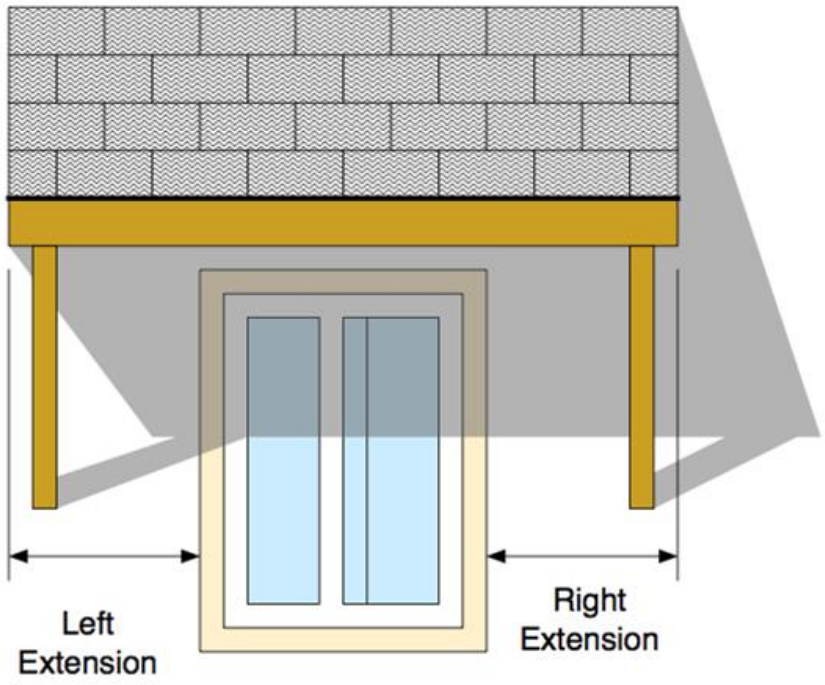
Overhangs, Sidefins and Other Shading Devices



Overhangs are described by some simple dimensions:

- Height of window
- Height above window
- Horizontal extension from face of window

Overhangs, Sidefins and Other Shading Devices



- Also, the distance that the overhang extends past the left and right edge of the window should be considered.

HERS Verification of Residential Envelope Measures

HERS Verification of Residential Envelope Measures

- There are two envelope special performance credits that, when taken, require field verification by a HERS Rater:
  - **Quality Insulation Installation (QII)**
  - **Reduced Infiltration**
- All other envelope measures are verified by building department personnel.

Quality Insulation Installation (QII)

- The CEC has taken a “guilty until proven innocent” approach and automatically de-rates insulation in the compliance software by a significant percentage.
- If the builder does not want this penalty, they can choose the Quality Insulation Installation (QII) credit, which requires that the insulation be HERS verified at various stages both pre and post insulation.
- **TIP: If the QII credit is taken, the HERS rater will perform a very thorough inspection on the insulation so the building inspector does not have to.**
- NOTE: QII will be more common in 2019 code and coordination will be very important

Reduced Infiltration (Blower Door Test)

- A builder can take credit for building an *extra* tight house, if they want to.
- This triggers HERS verification, which is accomplished by measuring how tight a house is by performing a blower door test.
- **TIP: If this verification is done, it is much less important for building inspectors to verify caulking and sealing.**

Let’s Look at the Envelope Measures on a 2022 CF1R-PRF-01

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD **CF1R-PRF-01E**

Project Name: 1 Story Example PV+Battery **Calculation Date/Time:** 2023-01-25T21:25:42-08:00 **(Page 1 of 14)**

Calculation Description: 1 Story Example **Input File Name:** 1storyExample.ribd22

GENERAL INFORMATION					
01	Project Name	1 Story Example PV+Battery			
02	Run Title	1 Story Example			
03	Project Location	715 P Street			
04	City	Sacramento, CA	05	Standards Version	2022
06	Zip code	95814	07	Software Version	CBECC-Res 2022.2.1
08	Climate Zone	12	09	Front Orientation (deg/ Cardinal)	0
10	Building Type	Single family	11	Number of Dwelling Units	1
12	Project Scope	Newly Constructed	13	Number of Bedrooms	3
14	Addition Cond. Floor Area (ft^2)	0	15	Number of Stories	1
16	Existing Cond. Floor Area (ft^2)	n/a	17	Fenestration Average U-factor	0.3
18	Total Cond. Floor Area (ft^2)	2100	19	Glazing Percentage (%)	18.60%
20	ADU Bedroom Count	n/a			

COMPLIANCE RESULTS	
01	Building Complies with Computer Performance
02	This building incorporates features that require field testing and/or verification by a certified HERS rater under the supervision of a CEC-approved HERS provider.
03	This building incorporates one or more Special Features shown below

Basic Info (Important)

Registration Number: Registration Date/Time: HERS Provider:

CA Building Energy Efficiency Standards - 2022 Residential Compliance Report Version: 2022.0.000 Schema Version: rev 20220901 Report Generated: 2023-01-25 21:27:17

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD CF1R-PRF-01E

Project Name: 1 Story Example PV+Battery **Calculation Date/Time:** 2023-01-25T21:25:42-08:00 **(Page 2 of 14)**

Calculation Description: 1 Story Example **Input File Name:** 1storyExample.ribd22

ENERGY DESIGN RATINGS

	Energy Design Ratings			Compliance Margins		
	Source Energy (EDR1)	Efficiency[1] EDR (EDR2efficiency)	Total[2] EDR (EDR2total)	Source Energy (EDR1)	Efficiency[1] EDR (EDR2efficiency)	Total[2] EDR (EDR2total)
Standard Design	42.9	43.2	33.9			
Proposed Design	38.1	41.9	27.3	4.8	1.3	6.6
RESULT[3]: PASS						

[1]Efficiency EDR includes improvements like a better building envelope and more efficient equipment

[2]Total EDR includes efficiency and demand response measures such as photovoltaic (PV) system and batteries

[3]Building complies when source energy, efficiency and total compliance margins are greater than or equal to zero and unmet load hour limits are not exceeded

- Standard Design PV Capacity: 2.80 kWdc
- PV System resized to 2.80 kWdc (a factor of 1.402) to achieve 'Standard Design PV' PV scaling

Shows if it Passes
(can't print form if it doesn't pass)

Registration Number: Registration Date/Time: HERS Provider:

CA Building Energy Efficiency Standards - 2022 Residential Compliance Report Version: 2022.0.000 Schema Version: rev 20220901 Report Generated: 2023-01-25 21:27:17

Project Name: 1 Story Example PV+Battery
Calculation Date/Time: 2023-01-25T21:25:42-08:00
Calculation Description: 1 Story Example
Input File Name: 1storyExample.ribd22

ENERGY USE SUMMARY

Energy Use	Standard Design Source Energy (EDR1) (kBtu/ft^2 -yr)	Standard Design TDV Energy (EDR2) (kTDV/ft^2 -yr)	Proposed Design Source Energy (EDR1) (kBtu/ft^2 -yr)	Proposed Design TDV Energy (EDR2) (kTDV/ft^2 -yr)	Compliance Margin (EDR1)	Compliance Margin (EDR2)
Space Heating	6.6	28.95	6.67	29.2	-0.07	-0.25
Space Cooling	0.42	14.92	0.31	11.15	0.11	3.77
IAQ Ventilation	0.33	3.56	0.33	3.56	0	0
Water Heating	1.39	14.67	1.61	16.42	-0.22	-1.75
Self Utilization/Flexibility Credit				0		0
Efficiency Compliance Total	**8.74**	**62.1**	**8.92**	**60.33**	**-0.18**	**1.77**
Photovoltaics	-1.09	-36.85	-1.09	-38.79		
Battery			-1.74	-11.98		
Flexibility						
Indoor Lighting	0.74	7.43	0.74	7.43		
Appl. & Cooking	2.86	19.63	2.86	19.63		
Plug Loads	2.59	27.07	2.59	27.07		
Outdoor Lighting	0.19	1.72	0.19	1.72		
TOTAL COMPLIANCE	**14.03**	**81.1**	**12.47**	**65.41**		

Shows if it Passes - Detail (TMI)

Registration Number:
Registration Date/Time:
HERS Provider:

CA Building Energy Efficiency Standards - 2022 Residential Compliance
Report Version: 2022.0.000
Schema Version: rev 20220901
Report Generated: 2023-01-25 21:27:17

ENERGY USE INTENSITY

	Standard Design (kBtu/ft^2 - yr)	Proposed Design (kBtu/ft^2 - yr)	Compliance Margin (kBtu/ft^2 - yr)	Margin Percentage
Gross EUI[1]	18.29	18.63	-0.34	-1.86
Net EUI[2]	11.1	11.5	-0.33	-2.95

Notes
1. Gross EUI is Energy Use Total (not including PV) / Total Building Area.
2. Net EUI is Energy Use Total (including PV) / Total Building Area.

REQUIRED PV SYSTEMS

01	02	03	04	05	06	07	08	09	10	11	12
DC System Size (kWdc)	Exception	Module Type	Array Type	Power Electronics	CFI	Azimuth (deg)	Tilt Input	Array Angle (deg)	Tilt: (x in 12)	Inverter Eff. (%)	Annual Solar Access (%)
2.8	NA	Standard (14-17%)	Fixed	none	True	150-270	n/a	n/a	<=7:12	96	98

BATTERY SYSTEMS

01	02	03	04	05	06	07
Control	Capacity (kWh)	Charging		Discharging		Round Trip Efficiency
		Charging Efficiency	Charging Rate (kW)	Discharging Efficiency	Discharging Rate (kW)	
Basic	5	0.95	n/a	0.95	n/a	0.9

Registration Number:

CA Building Energy Efficiency Standards - 2022 Residential Compliance

Registration Date/Time:

Report Version: 2022.0.000
Schema Version: rev 20220901

HERS Provider:

Report Generated: 2023-01-25 21:27:17

Shows How Much it Passes by (Kind of useful)

PV Info (Very Important)

Battery Info (Very Important)

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: 2.8 kWdc
- Battery System: 5 kWh
- Whole house fan
- Cool roof
- Insulation below roof deck
- Window overhangs and/or fins
- Northwest Energy Efficiency Alliance (NEEA) rated heat pump water heater; specific brand/model, or equivalent, must be installed

Special Features (Kind of Important)

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 buildng tables below. Registered CF2Rs and CF3Rs are required to be completed in the HERS Registry

- Quality insulation installation (QII)
- Indoor air quality ventilation
- Kitchen range hood
- Whole house fan airflow and fan efficacy
- Minimum Airflow
- Verified Refrigerant Charge
- Fan Efficacy Watts/CFM
- Duct leakage testing

HERS Features Info (Very Important)

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
1 Story Example PV+Battery	2100	1	3	1	1	1

Building Features (Kind of Important)

ZONE INFORMATION

01	02	03	04	05	06	07
Zone Name	Zone Type	HVAC System Name	Zone Floor Area (ft^2)	Avg. Ceiling Height	Water Heating System 1	Status
Conditioned	Conditioned	HVAC System 1	2100	9	DHW System	New

Zone Information (Kind of Important)

Project Name: 1 Story Example PV+Battery
Calculation Date/Time: 2023-01-25T21:25:42-08:00
Calculation Description: 1 Story Example
Input File Name: 1storyExample.ribd22

(Kind of Important)

OPAQUE SURFACES

01	02	03	04	05	06	07	08
Name	Zone	Construction	Azimuth	Orientation	Gross Area (ft^2)	Window and Door Area (ft2)	Tilt (deg)
Front	Conditioned	R21 R5 Stucco Wall	0	Front	270	146.25	90
Left	Conditioned	R21 R5 Stucco Wall	90	Left	324	72	90
Back	Conditioned	R21 R5 Stucco Wall	180	Back	450	154.02	90
Right	Conditioned	R21 R5 Stucco Wall	270	Right	414	38	90
GarToHouse Front	Conditioned>>Garage	Gar House R21	n/a	n/a	180	20	n/a
GarToHouse Left	Conditioned>>Garage	Gar House R21	n/a	n/a	90	0	n/a
Gar Ceiling	Garage	R0 ClgBlwAttic Cons	n/a	n/a	440	n/a	n/a
Ceiling (below attic) 1	Conditioned	R38 Ceiling below attic	n/a	n/a	2100	n/a	n/a
Gwall Front	Garage	Garage Wall R-0	0	Front	180	108	90
Gwall Left	Garage	Garage Wall R-0	90	Left	198	0	90
Gwall Right	Garage	Garage Wall R-0	270	Right	108	0	90

(Kind of Important)

ATTIC

01	02	03	04	05	06	07	08
Name	Construction	Type	Roof Rise (x in 12)	Roof Reflectance	Roof Emittance	Radiant Barrier	Cool Roof
Gar Attic	Tile Roof	Ventilated	5	0.2	0.85	No	No
Attic	Tile R-19 below deck	Ventilated	5	0.2	0.85	No	Yes

(Super of Important)

FENESTRATION / GLAZING

01	02	03	04	05	06	07	08	09	10	11	12	13	14
Name	Type	Surface	Orientation	Azimuth	Width (ft)	Height (ft)	Mult.	Area (ft^2)	U-factor	U-factor Source	SHGC	SHGC Source	Exterior Shading
F-6060	Window	Front	Front	0	6	6	1	36	0.3	NFRC	0.23	NFRC	Bug Screen
F-4050 x3	Window	Front	Front	0	4	5	3	60	0.3	NFRC	0.23	NFRC	Bug Screen

(Super of Important)

FENESTRATION / GLAZING

01	02	03	04	05	06	07	08	09	10	11	12	13	14
Name	Type	Surface	Orientation	Azimuth	Width (ft)	Height (ft)	Mult.	Area (ft^2)	U-factor	U-factor Source	SHGC	SHGC Source	Exterior Shading
F-1660 x2	Window	Front	Front	0	1.5	6	2	18	0.3	NFRC	0.23	NFRC	Bug Screen
F-3636	Window	Front	Front	0	3.5	3.5	1	12.25	0.3	NFRC	0.23	NFRC	Bug Screen
L-5040 x2	Window	Left	Left	90	5	4	2	40	0.3	NFRC	0.23	NFRC	Bug Screen
L-4040 x2	Window	Left	Left	90	4	4	2	32	0.3	NFRC	0.23	NFRC	Bug Screen
B1 SGD	Window	Back	Back	180	6	6.67	1	40.02	0.3	NFRC	0.23	NFRC	Bug Screen
B-6010	Window	Back	Back	180	6	1	1	6	0.3	NFRC	0.23	NFRC	Bug Screen
B-6040 x3	Window	Back	Back	180	6	4	3	72	0.3	NFRC	0.23	NFRC	Bug Screen
B-6050	Window	Back	Back	180	6	5	1	30	0.3	NFRC	0.23	NFRC	Bug Screen
B-3020	Window	Back	Back	180	3	2	1	6	0.3	NFRC	0.23	NFRC	Bug Screen
R-3030 x2	Window	Right	Right	270	3	3	2	18	0.3	NFRC	0.23	NFRC	Bug Screen
R-4050	Window	Right	Right	270	4	5	1	20	0.3	NFRC	0.23	NFRC	Bug Screen

(Not Important)

OPAQUE DOORS

01	02	03	04
Name	Side of Building	Area (ft^2)	U-factor
Front Dr	Front	20	0.2
GarToHouse Dr	GarToHouse Front	20	0.5
GDoor	Gwall Front	108	1

(Kind of Important)

OVERHANGS AND FINS

01	02	03	04	05	06	07	08	09	10	11	12	13	14
Window	Overhang					Left Fin				Right Fin			
	Depth	Dist Up	Left Extent	Right Extent	Flap Ht.	Depth	Top Up	Dist L	Bot Up	Depth	Top Up	Dist R	Bot Up
F-6060	1	1.33	3	10	0	0	0	0	0	0	0	0	0
F-4050 x3	1	1.33	6	6	0	0	0	0	0	0	0	0	0
F-1660 x2	4	1.33	3	3	0	0	0	0	0	0	0	0	0
F-3636	1	1.33	10	10	0	0	0	0	0	0	0	0	0
B1 SGD	6	1.33	4	4	0	0	0	0	0	0	0	0	0
B-6010	1	0	4	4	0	0	0	0	0	0	0	0	0
B-6040 x3	1	1.33	23	23	0	0	0	0	0	0	0	0	0
B-6050	1	1.33	10	10	0	0	0	0	0	0	0	0	0
B-3020	1	1.33	10	10	0	0	0	0	0	0	0	0	0

(Kind of Important)

SLAB FLOORS

01	02	03	04	05	06	07	08
Name	Zone	Area (ft^2)	Perimeter (ft)	Edge Insul. R-value and Depth	Edge Insul. R-value and Depth	Carpeted Fraction	Heated
Gslab	Garage	440	44	none	0	0%	No
Slab On Grade	Conditioned	2100	162	none	0	80%	No

(Very Important – If Required)

BUILDING ENVELOPE - HERS VERIFICATION				
01	02	03	04	05
Quality Insulation Installation (QII)	High R-value Spray Foam Insulation	Building Envelope Air Leakage	CFM50	CFM50
Required	Not Required	N/A	n/a	n/a

WATER HEATING SYSTEMS								
01	02	03	04	05	06	07	08	09
Name	System Type	Distribution Type	Water Heater Name	Number of Units	Solar Heating System	Compact Distribution	HERS Verification	Water Heater Name (#)
DHW System	Domestic Hot Water (DHW)	Standard	Heat Pump	1	n/a	None	n/a	Heat Pump (1)

WATER HEATERS - NEEA HEAT PUMP							
01	02	03	04	05	06	07	08
Name	# of Units	Tank Vol. (gal)	NEEA Heat Pump Brand	NEEA Heat Pump Model	Tank Location	Duct Inlet Air Source	Duct Outlet Air Source
Heat Pump	1	50	Generic	WhirlpoolHPSE2K50	Garage	Outside	Outside

WATER HEATING - HERS VERIFICATION						
01	02	03	04	05	06	07
Name	Pipe Insulation	Parallel Piping	Compact Distribution	Compact Distribution Type	Recirculation Control	Shower Drain Water Heat Recovery
DHW System - 1/1	Not Required	Not Required	Not Required	None	Not Required	Not Required

Best Practices for Energy Code Enforcement

Best Practices – Code Compliance

- Check the CF1R envelope measures against the plans. (Especially windows!)
- Inspect the non-HERS measures in the field, compare to CF2R. (Especially windows!)
- Use HERS registry to track forms for projects that require HERS verification.
- Know which HERS verified measures are required to avoid duplicate inspections.

Resources

2022 “BEES”

Publication #

CEC-400-2022-010

Resources

2022 Residential Compliance Manual covers

See Chapter 3"***Building Envelope Requirements***"

Publication #

CEC-400-2022-006

Closing

- Continuing Education Units Available
  - Contact shuskey@co.slo.ca.us for AIA and ICC LUs
- Coming to Your Inbox Soon!
  - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
  - Stay tuned for the 2023 Event Calendar!

Thank you!

For more info:
3c-ren.org

For questions:
info@3c-ren.org

3C REN

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