2022 Energy Code

Multifamily Envelope

California Energy Commission

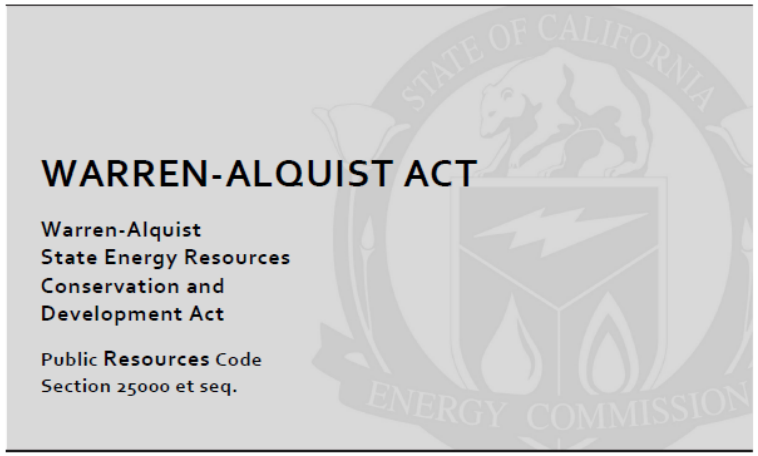
March 2023

Agenda

- Energy Code basics
- Navigating Energy Code
- Air sealing
- Vapor retarder
- Insulation and radiant barrier
- Roofing products
- Fenestration and exterior doors
- Resources

Energy Code Basics

Energy Code History

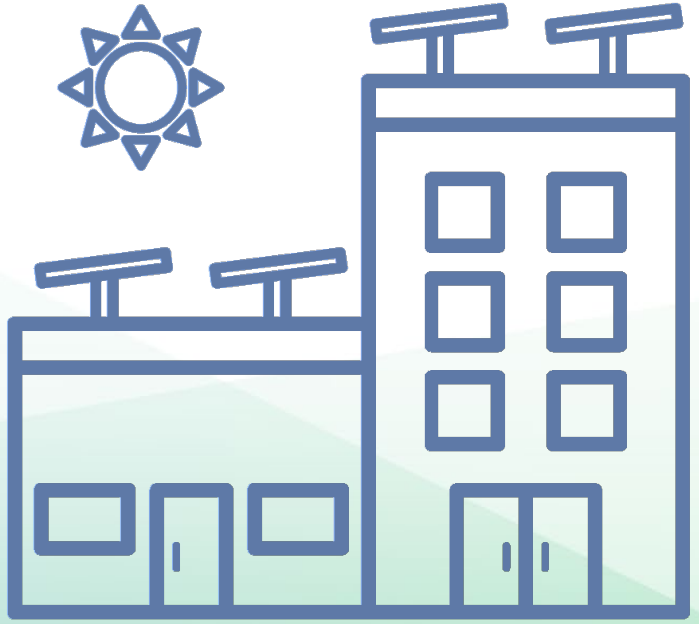


Warren-Alquist Act established California Energy Commission (CEC) in 1974

- Authority to develop and maintain Building Energy Efficiency Standards (Energy Code)
- Requires CEC to update periodically, usually every 3 years
- Requires Energy Code to be cost-effective over economic life of building

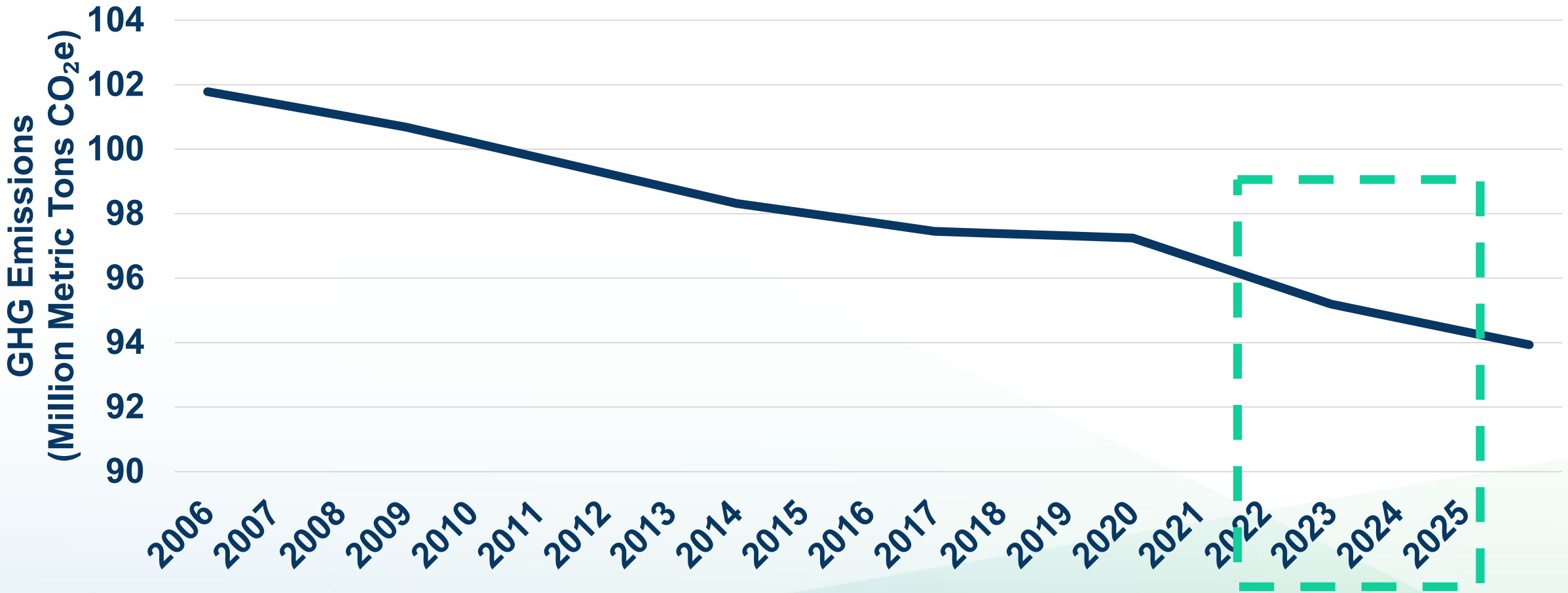
2022 Energy Code Goals

- Increase building energy efficiency cost-effectively
- Contribute to California's greenhouse gas (GHG) reduction goals
- Enable pathways for all-electric buildings
- Reduce residential building impacts on the electricity grid
- Promote demand flexibility and self-utilization of photovoltaic (PV)
- Provide tools for local government reach codes



Energy Code Environmental Benefit

Reduced Statewide Emissions

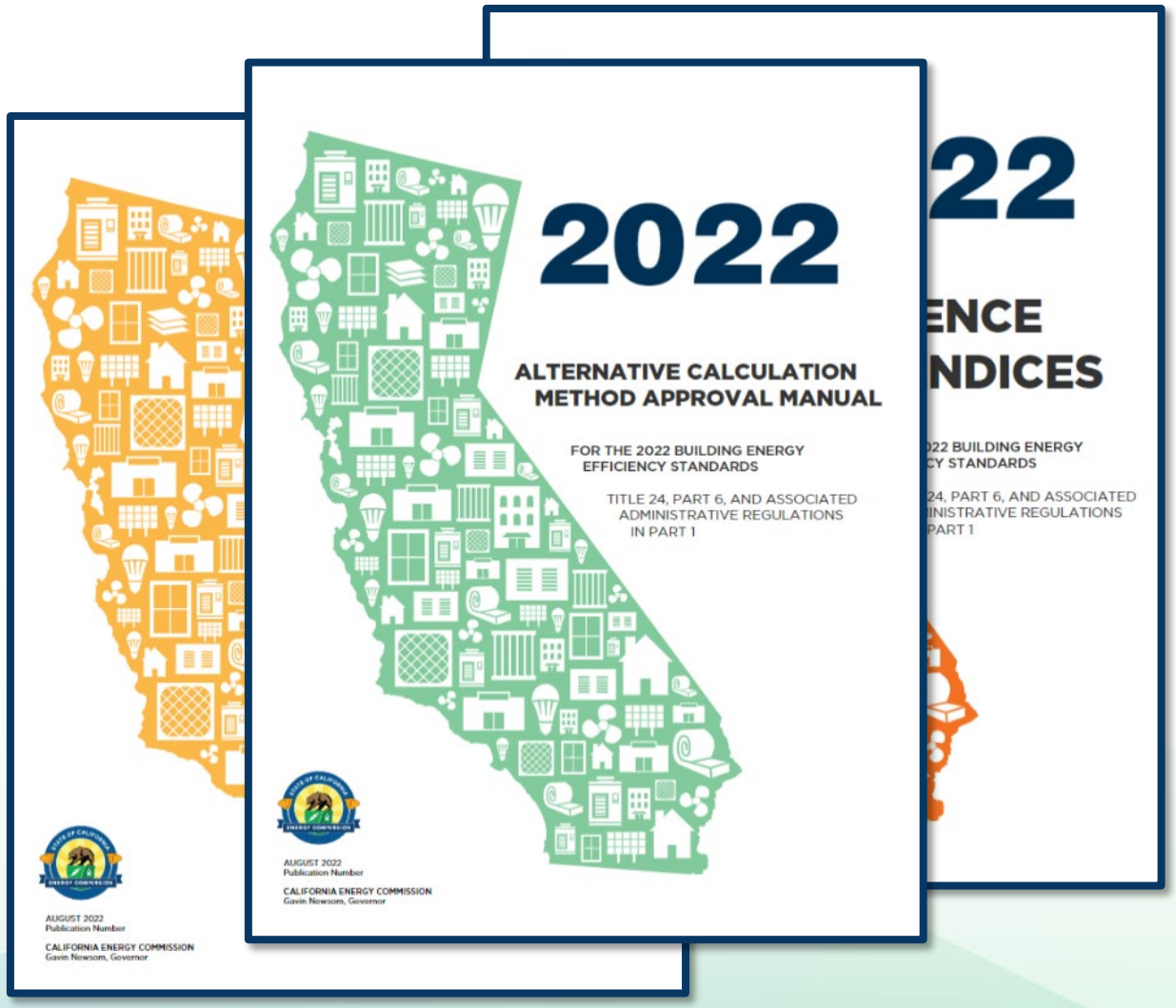


Source: CEC Impact Analysis 2005, 2008, 2013, 2016, 2019, 2022

2022 Energy Code

Effective January 1, 2023

- Building permit applications submitted on or after effective date
- Must use approved versions
  - Software
  - Forms



2022 Documents Online

- Energy Code
- Reference Appendices
- Compliance Manuals
- Software
- Forms

Energy Code Requirements

Mandatory requirements

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

Prescriptive requirements

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

Compliance Approaches

Prescriptive approach

- Simple approach, no trade-offs
- Defines the standard building design
- 2022 heat pump baselines

Performance approach

- Most flexible approach, allows for trade-offs
- Must meet all mandatory requirements
- Requires the use of CEC-approved software
- Proposed building design meets or exceeds standard building design

2022 Performance Metrics

New for 2022

Energy performance calculations

- Multifamily
  - Hourly source energy
  - Time dependent valuation (TDV)
    - TDV Efficiency
    - TDV Total
      - ❑ Efficiency, PV + battery

2022 Compliance Software

Performance approach must use approved compliance software versions

- Nonresidential and multifamily
  - CBECC 2022.3.0 or CBECC 2022.3.0 SP1
  - EnergyPro 9.2
  - IES 1.1

Demonstrating Compliance

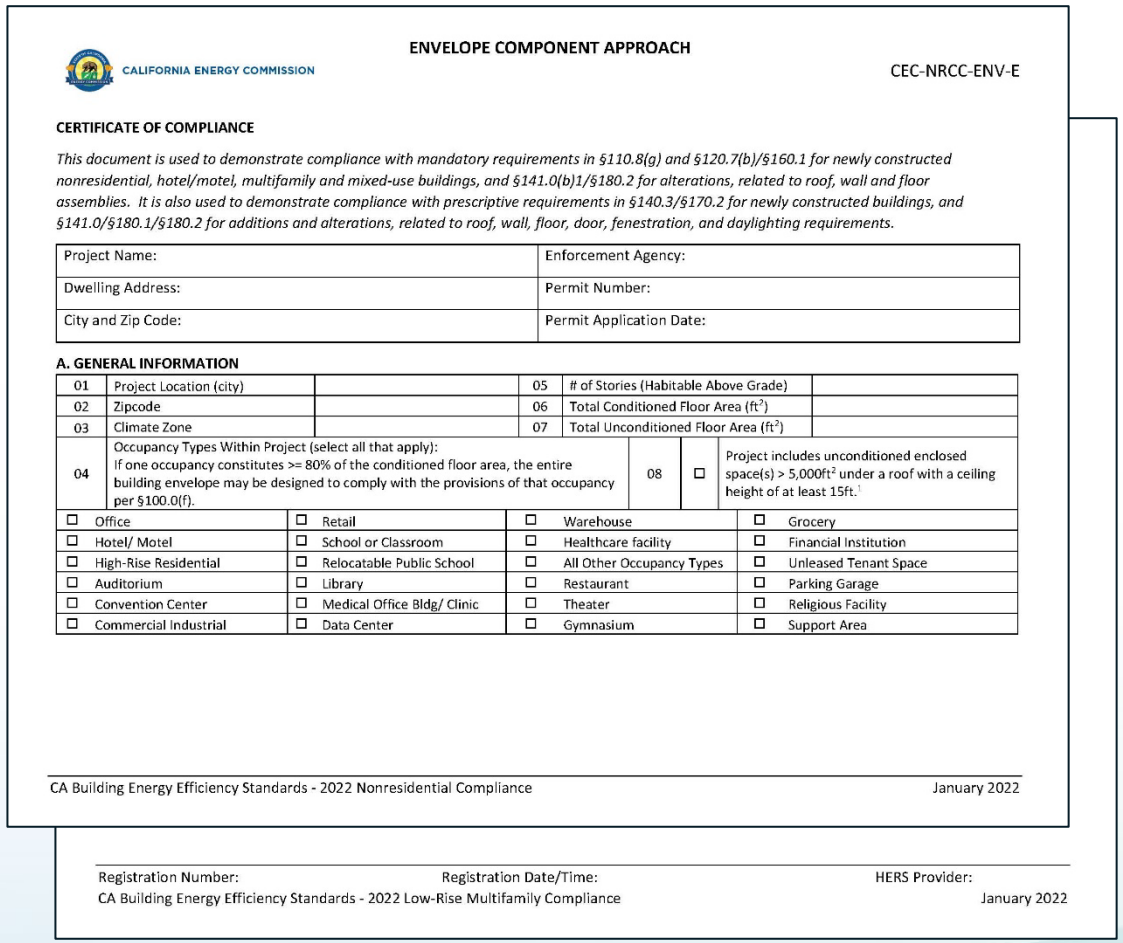
Updated for 2022

Compliance forms confirm Energy Code is met

- Completed by designers, consultants, builders, contractors, technicians, HERS raters, etc.
- Submitted to enforcement agencies for verification

Type of form	Multifamily 3 or less habitable stories	Multifamily 4 or more habitable stories
Certificate of compliance	LMCC	NRCC
Certificate of installation	LMCI	NRCI
Certificate of verification	LMCV	NRCV
Certificate of acceptance	-	NRCA

Certificate of Compliance



ENVELOPE COMPONENT APPROACH

CALIFORNIA ENERGY COMMISSION

CEC-NRCC-ENV-E

CERTIFICATE OF COMPLIANCE

This document is used to demonstrate compliance with mandatory requirements in §110.8(g) and §120.7(b)/§160.1 for newly constructed nonresidential, hotel/motel, multifamily and mixed-use buildings, and §141.0(b)1/§180.2 for alterations, related to roof, wall and floor assemblies. It is also used to demonstrate compliance with prescriptive requirements in §140.3/§170.2 for newly constructed buildings, and §141.0/§180.1/§180.2 for additions and alterations, related to roof, wall, floor, door, fenestration, and daylighting requirements.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

A. GENERAL INFORMATION

01	Project Location (city)		05	# of Stories (Habitable Above Grade)	
02	Zipcode		06	Total Conditioned Floor Area (ft^2)	
03	Climate Zone		07	Total Unconditioned Floor Area (ft^2)	
04	Occupancy Types Within Project (select all that apply): If one occupancy constitutes >= 80% of the conditioned floor area, the entire building envelope may be designed to comply with the provisions of that occupancy per §100.0(f).		08	☐	Project includes unconditioned enclosed space(s) > 5,000ft^2 under a roof with a ceiling height of at least 15ft.[1]

☐ Office	☐ Retail	☐ Warehouse	☐ Grocery
☐ Hotel/ Motel	☐ School or Classroom	☐ Healthcare facility	☐ Financial Institution
☐ High-Rise Residential	☐ Relocatable Public School	☐ All Other Occupancy Types	☐ Unleased Tenant Space
☐ Auditorium	☐ Library	☐ Restaurant	☐ Parking Garage
☐ Convention Center	☐ Medical Office Bldg/ Clinic	☐ Theater	☐ Religious Facility
☐ Commercial Industrial	☐ Data Center	☐ Gymnasium	☐ Support Area

CA Building Energy Efficiency Standards - 2022 Nonresidential Compliance — January 2022

Registration Number: Registration Date/Time: HERS Provider:

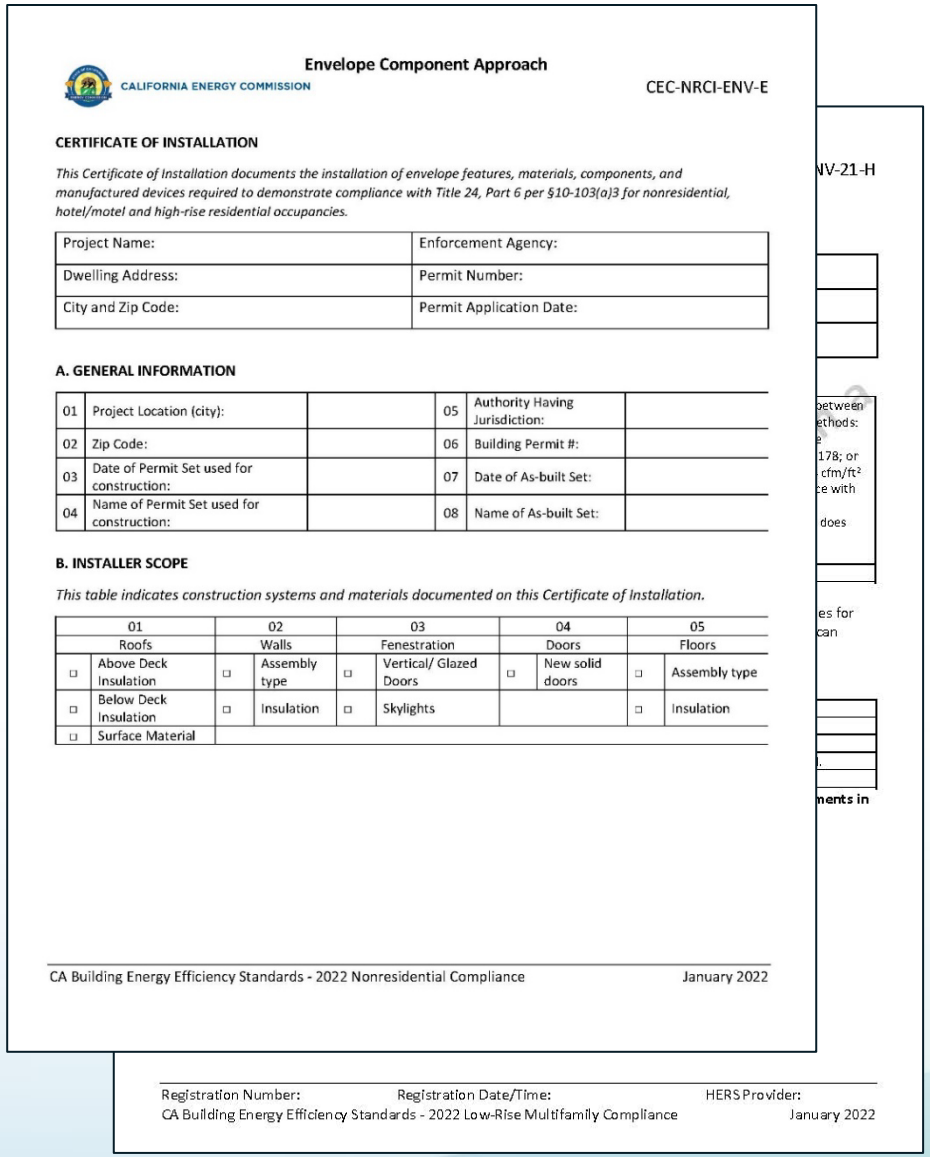
CA Building Energy Efficiency Standards - 2022 Low-Rise Multifamily Compliance — January 2022

Multifamily envelope

Certificate of compliance – LMCC or NRCC

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

Certificate of Installation



Envelope Component Approach

CALIFORNIA ENERGY COMMISSION

CEC-NRCI-ENV-E

CERTIFICATE OF INSTALLATION

This Certificate of Installation documents the installation of envelope features, materials, components, and manufactured devices required to demonstrate compliance with Title 24, Part 6 per §10-103(a)3 for nonresidential, hotel/motel and high-rise residential occupancies.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

A. GENERAL INFORMATION

01	Project Location (city):		05	Authority Having Jurisdiction:	
02	Zip Code:		06	Building Permit #:	
03	Date of Permit Set used for construction:		07	Date of As-built Set:	
04	Name of Permit Set used for construction:		08	Name of As-built Set:	

B. INSTALLER SCOPE

This table indicates construction systems and materials documented on this Certificate of Installation.

01 Roofs		02 Walls		03 Fenestration		04 Doors		05 Floors	
□	Above Deck Insulation	□	Assembly type	□	Vertical/ Glazed Doors	□	New solid doors	□	Assembly type
□	Below Deck Insulation	□	Insulation	□	Skylights			□	Insulation
□	Surface Material								

CA Building Energy Efficiency Standards - 2022 Nonresidential Compliance January 2022

Registration Number: Registration Date/Time: HERS Provider:

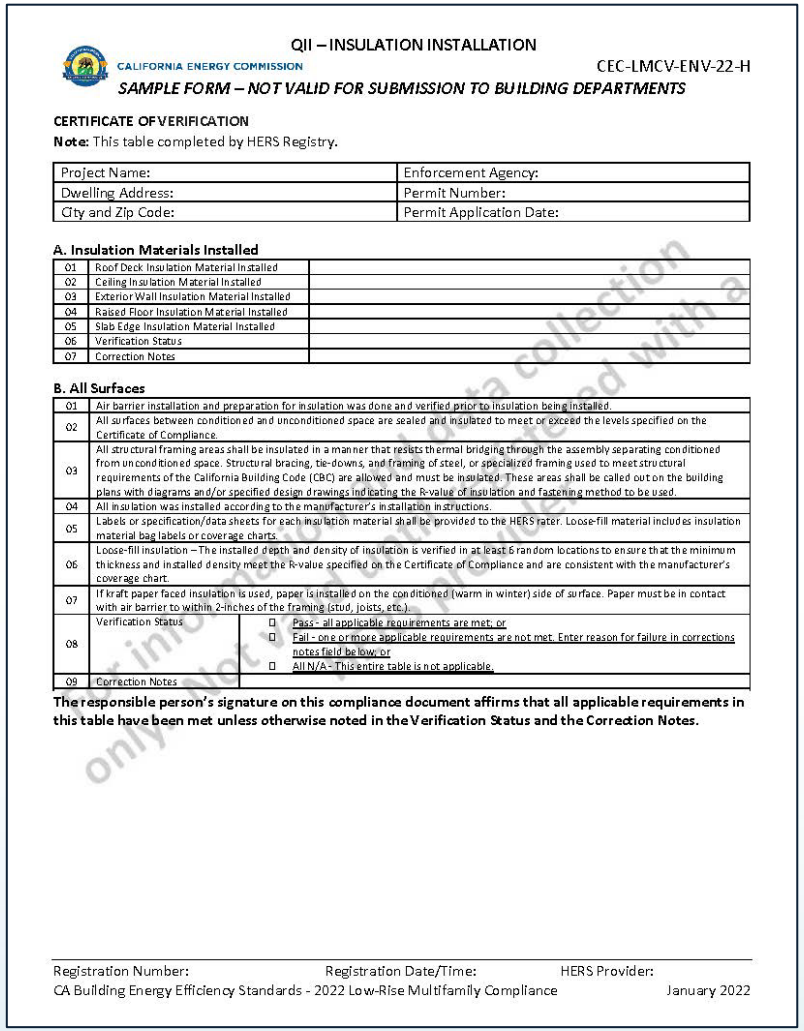
CA Building Energy Efficiency Standards - 2022 Low-Rise Multifamily Compliance January 2022

Multifamily

Certificate of installation – LMCI or NRCI

- Completed by installing contractor
- Confirms compliance at installation
- Left on-site for building inspector
- Identifies construction documents that show energy features were installed as proposed in the certificate of compliance
- Inspector verifies documented efficiency and components match installed equipment and systems

Certificates of Verification



QII – INSULATION INSTALLATION

CALIFORNIA ENERGY COMMISSION CEC-LMCV-ENV-22-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF VERIFICATION

Note: This table completed by HERS Registry.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

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 California Building Code (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-inches of the framing (stud, joists, etc.).	
08	Verification Status	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ 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.

Registration Number: Registration Date/Time: HERS Provider:

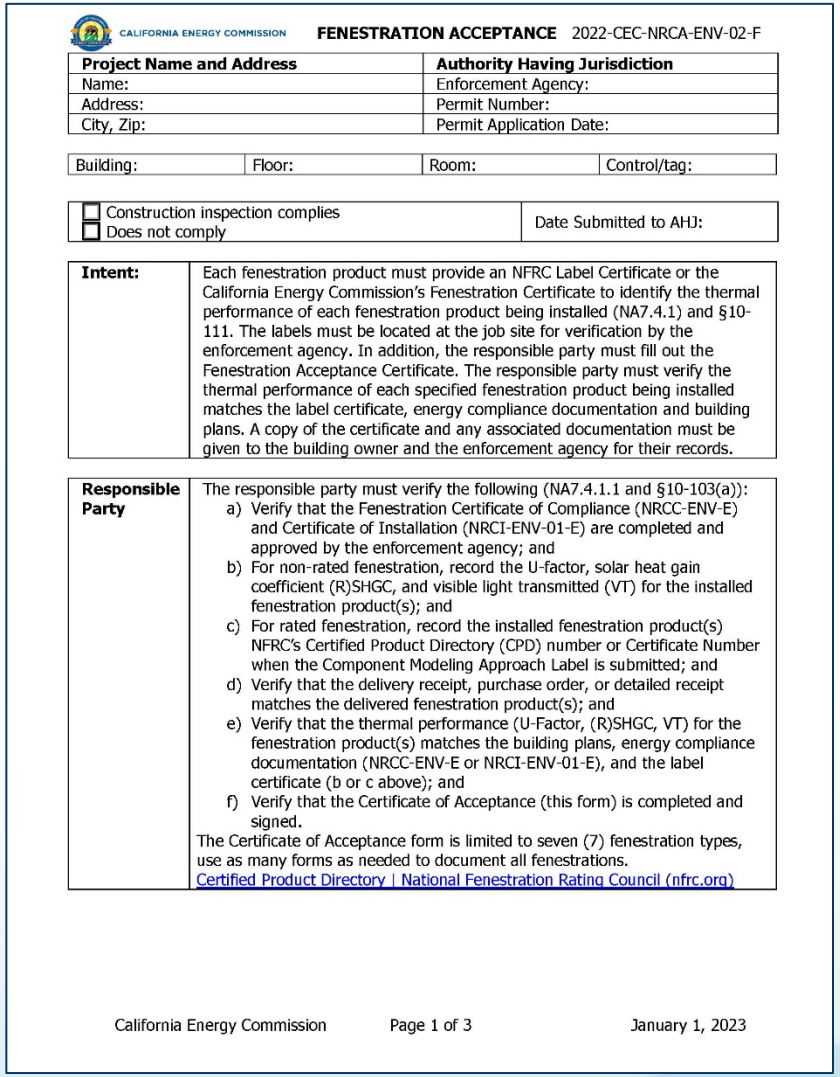
CA Building Energy Efficiency Standards - 2022 Low-Rise Multifamily Compliance January 2022

Multifamily envelope

Certificate of verification – LMCV or NRCV

- Completed by certified HERS rater
- Registered with approved HERS provider
- Confirms compliance with field verification and diagnostic testing requirements
  - Quality insulation installation
- Required for final inspection
- Inspector verifies tests and forms are complete, signed, and registered

Certificate of Acceptance



CALIFORNIA ENERGY COMMISSION **FENESTRATION ACCEPTANCE** 2022-CEC-NRCA-ENV-02-F

Project Name and Address	**Authority Having Jurisdiction**
Name:	Enforcement Agency:
Address:	Permit Number:
City, Zip:	Permit Application Date:

Building:	Floor:	Room:	Control/tag:

☐ Construction inspection complies ☐ Does not comply	Date Submitted to AHJ:

Intent:	Each fenestration product must provide an NFRC Label Certificate or the California Energy Commission's Fenestration Certificate to identify the thermal performance of each fenestration product being installed (NA7.4.1) and §10-111. The labels must be located at the job site for verification by the enforcement agency. In addition, the responsible party must fill out the Fenestration Acceptance Certificate. The responsible party must verify the thermal performance of each specified fenestration product being installed matches the label certificate, energy compliance documentation and building plans. A copy of the certificate and any associated documentation must be given to the building owner and the enforcement agency for their records.

Responsible Party	The responsible party must verify the following (NA7.4.1.1 and §10-103(a)): a) Verify that the Fenestration Certificate of Compliance (NRCC-ENV-E) and Certificate of Installation (NRCI-ENV-01-E) are completed and approved by the enforcement agency; and b) For non-rated fenestration, record the U-factor, solar heat gain coefficient (R)SHGC, and visible light transmitted (VT) for the installed fenestration product(s); and c) For rated fenestration, record the installed fenestration product(s) NFRC's Certified Product Directory (CPD) number or Certificate Number when the Component Modeling Approach Label is submitted; and d) Verify that the delivery receipt, purchase order, or detailed receipt matches the delivered fenestration product(s); and e) Verify that the thermal performance (U-Factor, (R)SHGC, VT) for the fenestration product(s) matches the building plans, energy compliance documentation (NRCC-ENV-E or NRCI-ENV-01-E), and the label certificate (b or c above); and f) Verify that the Certificate of Acceptance (this form) is completed and signed. The Certificate of Acceptance form is limited to seven (7) fenestration types, use as many forms as needed to document all fenestrations. Certified Product Directory | National Fenestration Rating Council (nfrc.org)

California Energy Commission Page 1 of 3 January 1, 2023

Multifamily envelope

Certificate of acceptance - NRCA

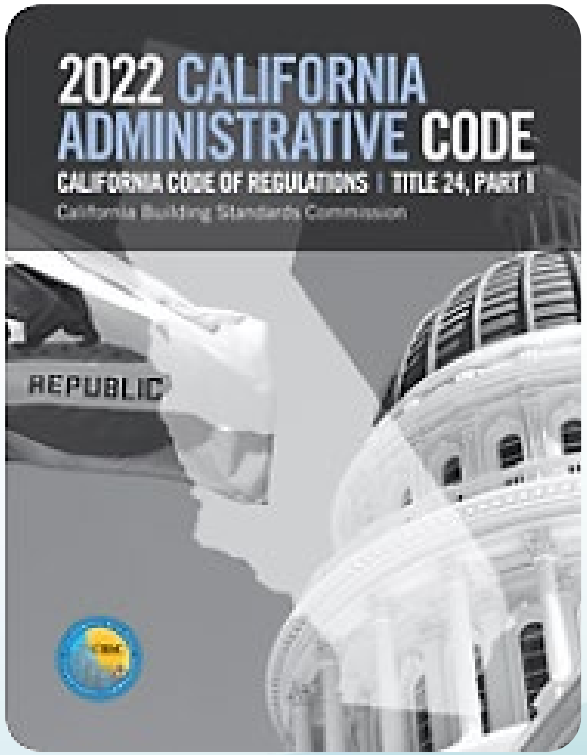
- Completed by field technician
- Confirms compliance with acceptance requirements in Reference Nonresidential Appendix NA7
- Left on-site for building inspector

Navigating Energy Code

Title 24 – California Building Code

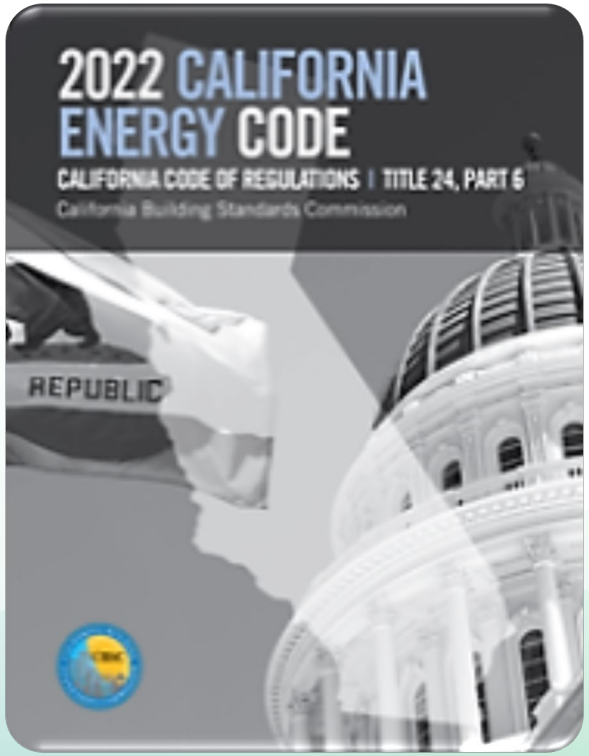
Part 1 - Administrative Code

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



Part 6 - Energy Code

- Subchapters 1 – 9
- §§ 100.0 – 180.4
- 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

2022 Energy Code Table 100.0-A

Occupancies	Application	Mandatory	Prescriptive	Performance	Additions/Alterations
All Buildings	General	100.0, 100.1, 100.2, 110.0	100.0, 100.1, 100.2, 110.0	100.0, 100.1, 100.2, 110.0	100.0, 100.1, 100.2, 110.0
Multifamily	General	160.0	170.2	170.1	180.0
Multifamily	Envelope (conditioned)	110.6, 110.7, 110.8, 160.1	170.2(a), (b)	170.1	180.1, 180.2
Multifamily	Ventilation and Indoor Air Quality	160.2	N.A.	170.1	180.1, 180.2
Multifamily	HVAC (conditioned)	110.2, 110.5, 160.3	170.2(c)	170.1	180.1, 180.2
Multifamily	Water Heating	110.3, 160.4	170.2(d)	170.1	180.1, 180.2
Multifamily	Indoor Lighting	110.9, 160.5	170.2(e)	170.1	180.1, 180.2
Multifamily	Outdoor Lighting	110.9, 160.5	170.2(e)	170.1	180.1, 180,2
Multifamily	Electrical Power Distribution	110.11, 160.6	N.A.	N.A.	180.1, 180.2
Multifamily	Pool and Spa Systems	110.4, 110.5, 160.7	N.A.	N.A.	180.1, 180.2
Multifamily	Solar Ready Buildings	110.10, 160.8	N.A.	N.A.	180.1, 180.2
Multifamily	Electric Ready	160.9	N.A.	N.A.	N.A.
Multifamily	Solar PV and Battery Storage Systems	N.A.	170.2(f), (g), (h)	170.1	N.A.

Multifamily relevant sections

§100.1 Definitions

§ 110.0-110.12 All buildings

§ 160.0-160.9 Mandatory requirements

§ 170.0-170.2 Prescriptive requirements

§ 180.0-180.4 Additions and alterations

Restructuring of Multifamily Mandatory Requirements

New for 2022

2019 Sections with Multifamily	2022 Newly Created Sections
§120.0: High-rise residential • Mandatory requirements §§ 130.0-130.4: High-rise residential • Mandatory requirements for lighting systems and equipment §130.5: High-rise residential • Mandatory requirements for electrical power distribution systems §150.0: Low-rise residential • Mandatory features and devices	§§160.0-160.9: Multifamily buildings • Mandatory requirements

Restructuring of Multifamily Prescriptive Requirements

New for 2022

2019 Sections with Multifamily	2022 Newly Created Sections
§§140.0-140.8: High-rise residential • Performance and prescriptive compliance approaches §150.1: Low-rise residential • Performance and prescriptive compliance approaches	§§170.0-170.2: Multifamily buildings • Performance and prescriptive compliance approaches

Restructuring of Multifamily Addition Alteration Requirements

New for 2022

2019 Sections with Multifamily	2022 Newly Created Sections
§141.0: High-rise residential • Additions, alterations, and repairs §150.2: Low-rise residential • Additions and alterations to existing low-rise residential buildings	§§180.0-180.4: Multifamily buildings • Additions, alterations, and repairs to existing multifamily buildings

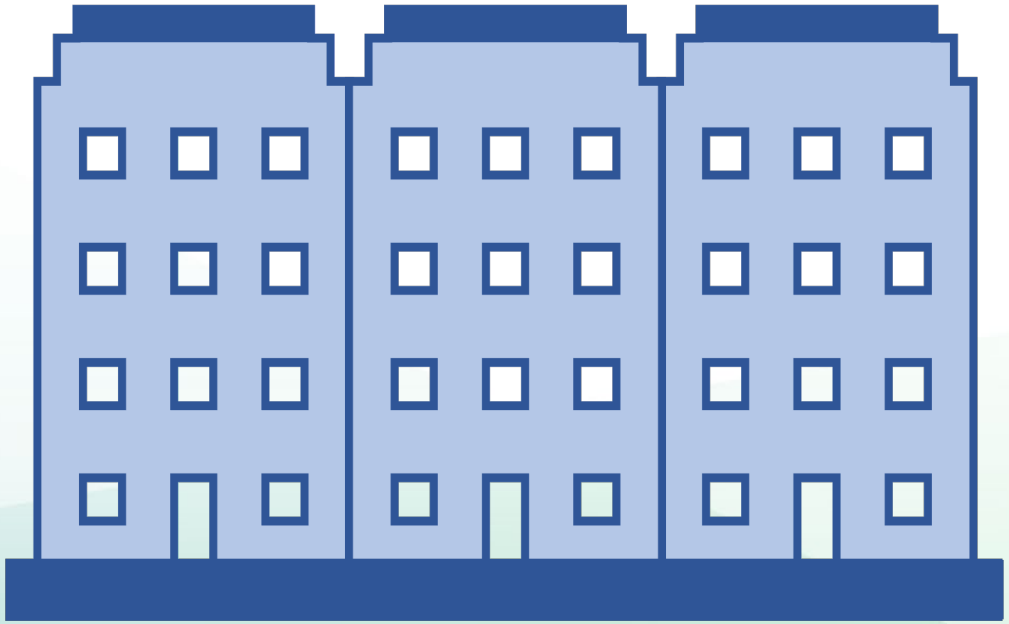
Multifamily Defined

All buildings § 100.1

New for 2022

Multifamily building

- Occupancy group R-2
  - Not hotel/motel building or timeshare property
- Occupancy group R-3 non-transient congregate residence
  - Not boarding houses of more than 6 guests
  - Not alcohol or drug abuse recovery homes of more than 6 guests
- Occupancy group R-4



Multifamily Definitions

All buildings § 100.1

Updated for 2022

Low-rise residential building

- R-2 multifamily with three habitable stories or less
- Not hotel or motel

High-rise residential building

- R-2 or R-4 with four or more habitable stories
- Not hotel or motel

Envelope Defined

All buildings § 100.1

Building envelope - ensemble of exterior and demising partitions of a building that enclose conditioned space

Roof

Windows

Walls

Floors

Envelope Definitions

All buildings § 100.1

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

Check Your Understanding

Mixed-use buildings

How does a building with ground floor retail and restaurants plus three stories of residential above comply with Energy Code?

- Retail (occupancy M) and restaurant (occupancy A) must meet the nonresidential requirements
- Dwelling units and common use areas (occupancy R) must meet the multifamily requirements

Air Sealing

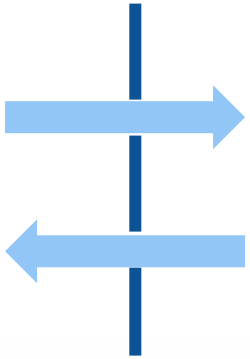
Multifamily

Mandatory § 110.7

Multifamily § 170.2(a)6

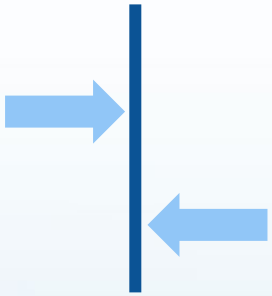
Air Sealing Definitions

All buildings § 100.1



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

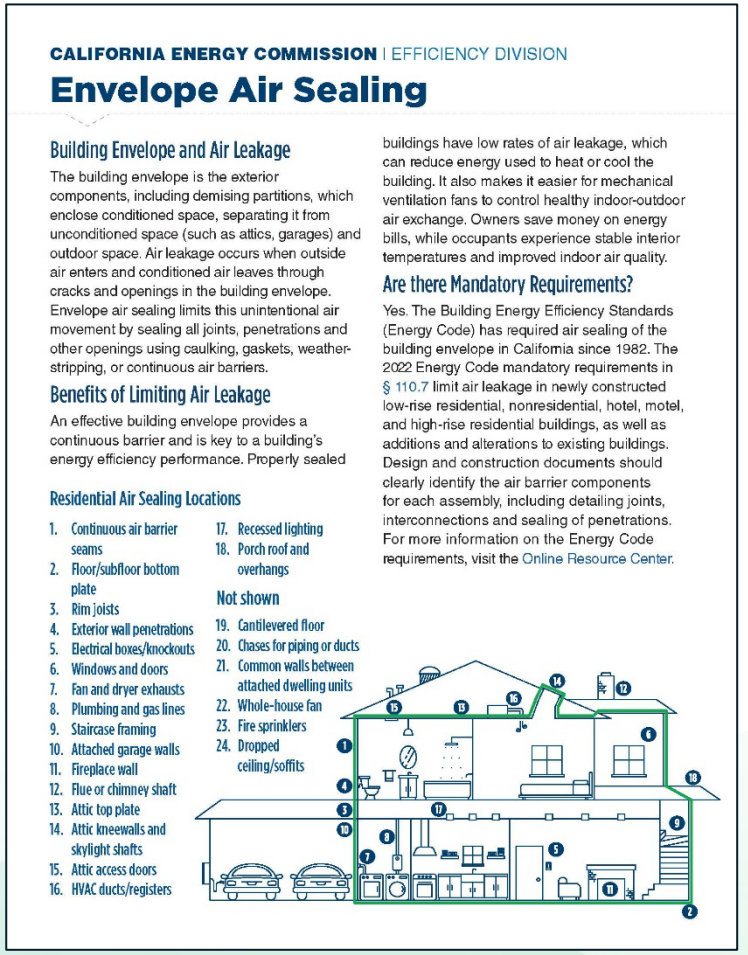
Air Sealing Mandatory Requirements

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.



CALIFORNIA ENERGY COMMISSION | EFFICIENCY DIVISION

Envelope Air Sealing

Building Envelope and Air Leakage

The building envelope is the exterior components, including demising partitions, which enclose conditioned space, separating it from unconditioned space (such as attics, garages) and outdoor space. Air leakage occurs when outside air enters and conditioned air leaves through cracks and openings in the building envelope. Envelope air sealing limits this unintentional air movement by sealing all joints, penetrations and other openings using caulking, gaskets, weather-stripping, or continuous air barriers.

Benefits of Limiting Air Leakage

An effective building envelope provides a continuous barrier and is key to a building's energy efficiency performance. Properly sealed buildings have low rates of air leakage, which can reduce energy used to heat or cool the building. It also makes it easier for mechanical ventilation fans to control healthy indoor-outdoor air exchange. Owners save money on energy bills, while occupants experience stable interior temperatures and improved indoor air quality.

Are there Mandatory Requirements?

Yes. The Building Energy Efficiency Standards (Energy Code) has required air sealing of the building envelope in California since 1982. The 2022 Energy Code mandatory requirements in § 110.7 limit air leakage in newly constructed low-rise residential, nonresidential, hotel, motel, and high-rise residential buildings, as well as additions and alterations to existing buildings. Design and construction documents should clearly identify the air barrier components for each assembly, including detailing joints, interconnections and sealing of penetrations. For more information on the Energy Code requirements, visit the Online Resource Center.

Residential Air Sealing Locations

1. Continuous air barrier seams
2. Floor/subfloor bottom plate
3. Rim joists
4. Exterior wall penetrations
5. Electrical boxes/knockouts
6. Windows and doors
7. Fan and dryer exhausts
8. Plumbing and gas lines
9. Staircase framing
10. Attached garage walls
11. Fireplace wall
12. Flue or chimney shaft
13. Attic top plate
14. Attic kneewalls and skylight shafts
15. Attic access doors
16. HVAC ducts/registers
17. Recessed lighting
18. Porch roof and overhangs

Not shown

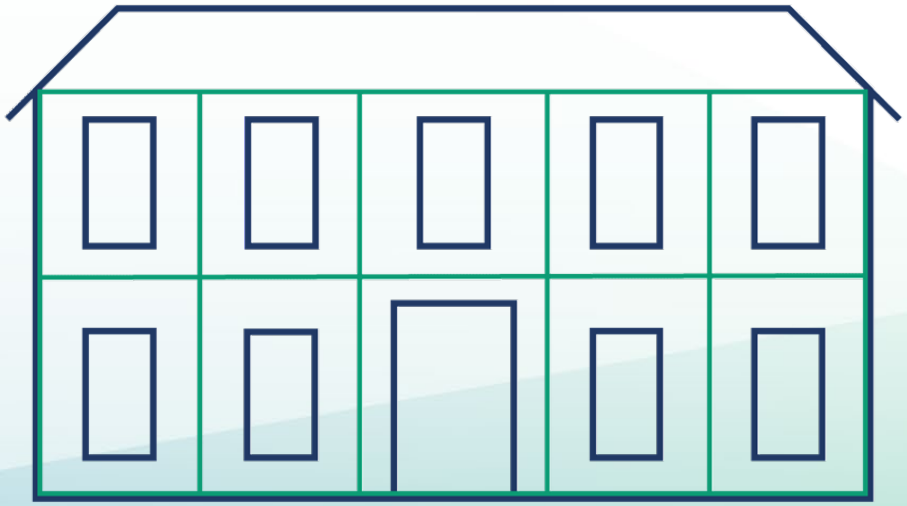
19. Cantilevered floor
20. Chases for piping or ducts
21. Common walls between attached dwelling units
22. Whole-house fan
23. Fire sprinklers
24. Dropped ceiling/soffits

Air Sealing Mandatory Requirements

Multifamily § 160.2(b)2Aivb2

Dwelling unit continuous supply or exhaust ventilation

- Compartmentalization testing
- Dwelling unit envelope leakage
  - 0.3 cubic feet or less per minute at 50 Pascals
  - HERS verified per RA3.8 or NA2.3



Air Sealing Prescriptive Requirements

Multifamily § 170.2(a)6

Quality insulation installation (QII)

- Required per Table 170.2-A
- Three habitable stories or less
- Climate zones 1-6 and 8-16
  - Climate zone 7 excluded
- HERS verified per RA3.5
- Includes air barrier verification

Vapor Retarder
Multifamily

Mandatory § 160.1(d)

Vapor Retarder Definition

All buildings § 100.1

Vapor retarder class - ability of material or assembly to limit the amount of moisture that passes through, meeting CBC Section 202 per ATSM E96

- Class I examples
  - Polyethylene sheet
  - Non-perforated aluminum foil
  - Asphalt roofing shingle
- Class II examples
  - Plywood
  - Kraft-faced insulation batt
  - Roofing felts
- Class III examples
  - Latex paint coat
  - Gypsum board
  - Concrete block

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

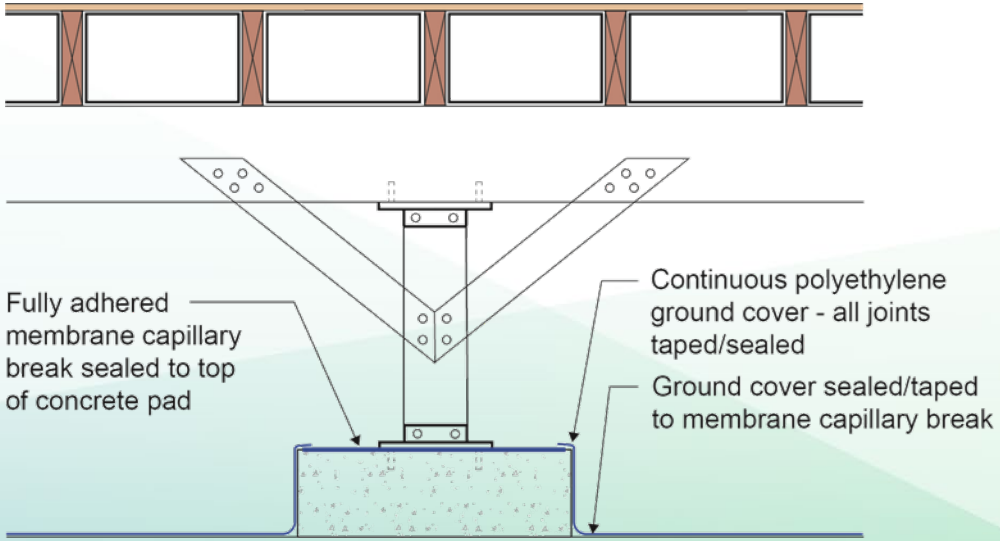
Vapor Retarder Mandatory Requirements

Multifamily § 160.1(d)

New for 2022

Vapor retarder

- All climate zones
  - Earth floor covered with Class I or Class II
  - Also applies to controlled ventilation meeting exception 160.1(c)
- Climate zones 14 and 16
  - Vapor retarder on conditioned side of exterior walls, vented attic, and unvented attics with air-permeable insulation



Insulation and Radiant Barrier Requirements

Multifamily

Mandatory § 110.8, § 160.1(a-c)

Prescriptive § 170.2(a)

Alterations § 180.2

Insulation Definitions

All buildings § 100.1

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)

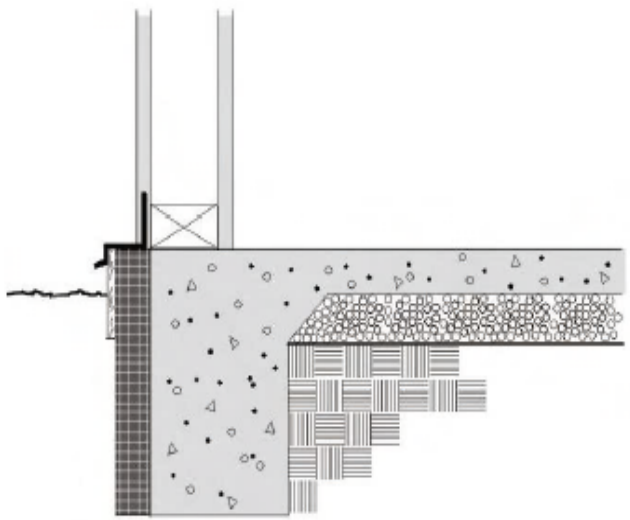
All materials

- Certified to Standards for Insulation Materials (Title 24, Part 12) by the California Department of Consumer Affairs, Bureau of Household Goods and Services
- Restricts use of formaldehyde foam
- Must have fire-retardant on exposed surfaces and be installed according to California Building Code

Insulation Mandatory Requirements

All Buildings § 110.8(g-h)

Figure 3-6: Perimeter Slab Insulation



Heated slab floors

- Meet requirements in Table 110.8-A for R-value and climate zone
- Must be certified per § 110.8(a)
- Water absorption rate maximum 0.3%
- Vapor permeable maximum 2.0 perm per inch
- 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

Wet insulation systems above roofs waterproof membrane

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

Radiant Barrier Mandatory Requirements

All buildings §§ 100.1, 110.8(j)

Radiant barrier - highly reflective, low emitting material installed underside of roof deck and inside of gable ends or exterior vertical surfaces in attics to reduce solar heat gain

- Emittance of 0.05 or less
- Tested per ASTM C1371 or E408
- Certified to CA Department of Consumer Affairs

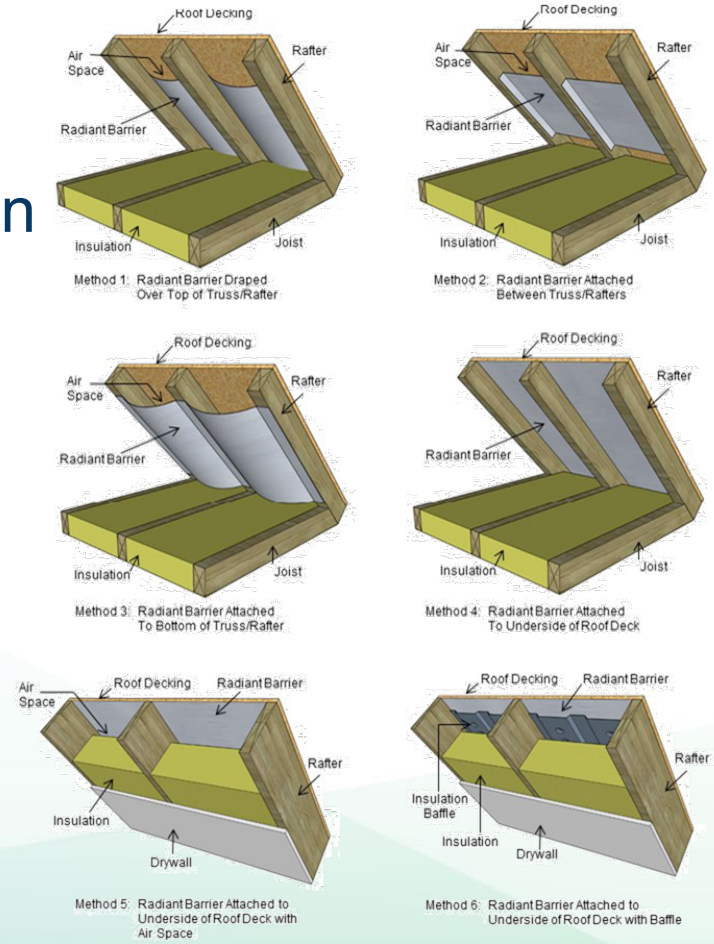
Radiant Barrier Prescriptive Requirements

Multifamily § 170.2(a)1C

Radiant barrier per Table 170.2-A

- Depends on climate zone and roof insulation option
- Not required with under roof deck insulation
- Installed per Reference Residential Appendix RA4
  - Shiny side facing attic
  - On gable ends
  - Minimum free ventilation area

Figure 3-13: Methods of Installation for Radiant Barriers



Insulation Mandatory Requirements

Multifamily § 160.1(a)

New for 2022

Ceiling and roof

- Attic roof
  - Maximum U-factor 0.043
    - Wood-framed R-22
  - Attic access door insulation permanently attached
  - Loose-fill meets weight per square foot per manufacturer
- Non-attic roof
  - Metal building maximum U-factor 0.098
  - Wood framed and others maximum U-factor 0.075
  - No fixed vents when insulation at roof in conditioned space
- Insulation in direct contact with roof or ceiling air-sealed per §110.7

Insulation Prescriptive Requirements

Multifamily § 170.2(a)1Bii, Table 170.2-A

Updated for 2022

Roof and ceiling insulation

- Option B: Attic with below roof deck insulation

TABLE 170.2-A: Option B Roof and Ceiling Insulation Maximum U-Factors

Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Below Roof Deck Insulation [1,2] (With Air Space)	NR	NR	NR	R19	NR	NR	NR	R19	R19	R13	R19	R19	R19	R19	R19	R13
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

Insulation Prescriptive Requirements

Multifamily § 170.2(a)1Biii, Table 170.2-A

Updated for 2022

Ceiling insulation

- Option C: Attic with ducts in conditioned space

TABLE 170.2-A: Option C Ceiling Insulation Maximum U-Factors

Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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

Insulation Prescriptive Requirements

Multifamily § 170.2(a)1Biv, Table 170.2-A

Updated for 2022

Roof insulation

- Option D: Non-attic roof

TABLE 170.2-A: Option D Non-attic Roof Insulation Maximum U-Factors

Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Metal Building U-factor	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041
Wood Framed and Other U-factor	0.028	0.028	0.034	0.028	0.034	0.034	0.039	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028

Insulation Mandatory Requirements

Multifamily § 160.1(b)

New for 2022

Wall insulation by assembly type

Assembly Type	Maximum U-factor
Metal buildings	0.113
Metal-framed walls (includes demising)	0.151
Wood-framed 2x4 walls	0.102
Wood-framed 2x6 walls	0.071
Wood-framed demising walls	0.099
Other wall assemblies	0.102
Light mass walls 6” hollow core	0.440
Heavy mass walls 8+” hollow core	0.690
Spandrel panel and opaque curtain walls	0.280
Bay window roofs and floors meet wall requirements per Table 170.2-A	

Insulation Prescriptive Requirements

Multifamily § 170.2(a)2, Table 170.2-A

New for 2022

Wall insulation U-factors by assembly type

- Demising walls meet mandatory per 160.1(b)7

TABLE 170.2-A: Wall Insulation Maximum U-Factors

Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Metal-Building any fire rating	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.057	0.057	0.057	0.057	0.057
Framed (wood, metal, and others) >1hr fire rating	0.059	0.059	0.059	0.059	0.059	0.065	0.065	0.059	0.059	0.059	0.051	0.059	0.059	0.051	0.051	0.051
Framed (wood, metal and others) ≤1hr fire rating[3]	0.051	0.051	0.051	0.051	0.051	0.065	0.065	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
Mass Light [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 Heavy	0.253	0.065	0.065	0.065	0.065	0.690	0.690	0.690	0.690	0.065	0.184	0.253	0.211	0.184	0.184	0.160

Insulation Mandatory Requirements

Multifamily § 160.1(c)

New for 2022

Floor and soffit

- Raised mass - maximum U-factor 0.269
- Raised wood - maximum U-factor 0.037
- Other - maximum U-factor 0.071
- Heated slab insulated per 110.8(g)
- Exception for controlled ventilation or unvented crawlspace if all apply
  - Foundation walls insulated per Table 170.2-A
  - Class I or Class II vapor retarder in crawlspace
  - Vented with automatic louvers
  - Meet RA4.5.1

Insulation Prescriptive Requirements

Multifamily § 170.2(a)5, Table 170.2-A

Updated for 2022

Floor insulation by assembly type

TABLE 170.2-A: Floor/soffit Insulation Maximum U-Factors

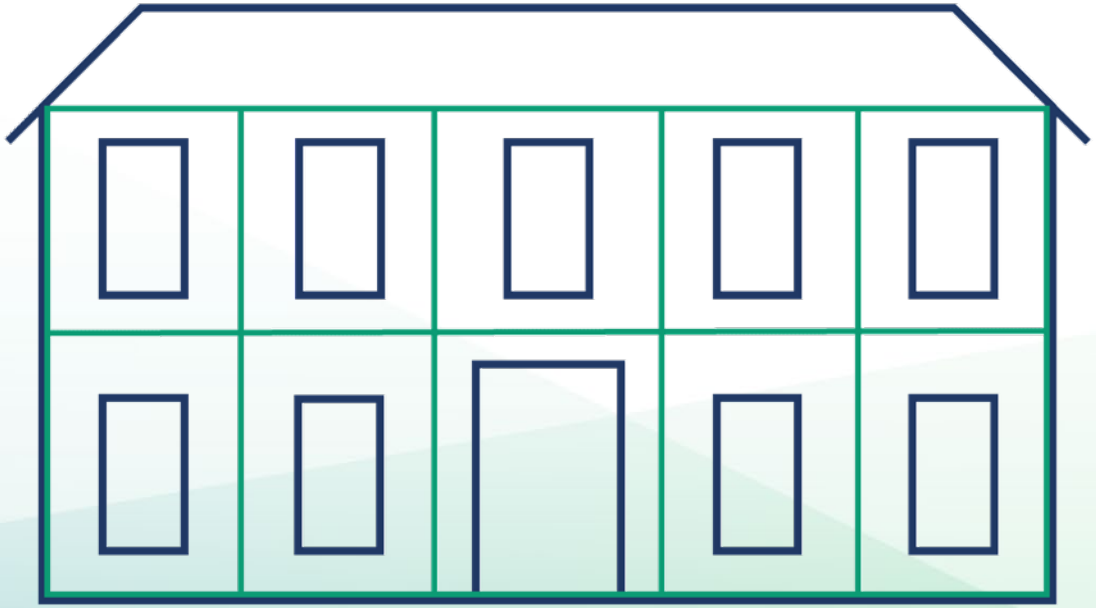
Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Slab Perimeter, Three Habitable Stories or less	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R 7.0
Wood Framed	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 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
Raised Mass	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
Other	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039

Insulation Prescriptive Requirements

Multifamily § 170.2(a)6

Quality insulation installation (QII)

- Required per Table 170.2-A
- Three habitable stories or less
- Climate zones 1-6 and 8-16
  - Climate zone 7 excluded
- HERS verified per RA3.5
- Includes air barrier verification



Insulation Additions Prescriptive Requirements

Multifamily § 180.1(a)1A

New for 2022

Additions greater than 700 square feet

Meet § 170.2(a) with modifications

- Framed walls extensions of existing wood-framed walls
  - R-15 in 2x4 framing and R-21 in 2x6 framing
  - Continuous insulation is not required
- When existing siding of wood-framed wall not altered
  - R-15 in 2x4 framing and R-21 in 2x6 framing
  - Continuous insulation is not required
- Conversion of existing spaces from unconditioned to conditioned
  - No air sealing with QII when existing air barrier not altered

Insulation Additions Prescriptive Requirements

Multifamily § 180.1(a)1B

New for 2022

Additions 700 square feet or less

Meet § 170.2(a) with modifications

- Roof and ceiling
  - Climate zones 1, 2, 4, 8-16 maximum U-factor 0.025
    - R-38 in wood framing
  - Climate zones 3, 5-7 maximum U-factor 0.031
    - R-30 in wood framing
  - Exception: enclosed rafter ceilings meet 160.1(a)
- Radiant barrier in climate zones 2-15 for 3 or less habitable stories
- Framed walls extensions of existing wood-framed walls
  - R-15 in 2x4 framing and R-21 in 2x6 framing
- QII not required

Insulation Alterations Mandatory Requirements

Multifamily § 180.2(a)1-3

New for 2022

Roof and ceiling insulation

- Meet prescriptive § 180.2(b)1B

Wall insulation

- Metal building: minimum R-13 or area-weighted maximum U-factor 0.113
- Metal framed: minimum R-13 or area-weighted maximum U-factor 0.217
- Wood framed and others: minimum R-11 or area-weighted maximum U-factor 0.110
- Spandrel panels and curtain walls: minimum R-4 or area-weighted maximum U-factor 0.280
- Exception: Light and heavy mass walls

Floor insulation

- Raised framed floors: minimum of R-11 or area-weighted maximum U-factor 0.071
- Raised mass floors: minimum of R-6 or area-weighted maximum U-factor 0.111

Insulation Alterations Prescriptive Requirements

Multifamily § 180.2(b)1Aiii

Updated for 2022

Area of roof replacements and recover triggers insulation

- Above deck roof insulation for low-sloped roofs
  - Climate zones 1, 2, 4, 8-16
    - R-14 or U-factor 0.039
  - Exceptions
    - Roof recovers with new R-10 insulation added above deck
    - Existing mechanical equipment located on roof not disconnected and lifted, limited to R-10 or maximum allow per manufacturer
    - At drains and other low points, tapered insulation less than R-14, if average thermal resistance equals or exceeds R-14
    - Area of the roof recoat

Insulation Alterations Prescriptive Requirements

Multifamily § 180.2(b)1B

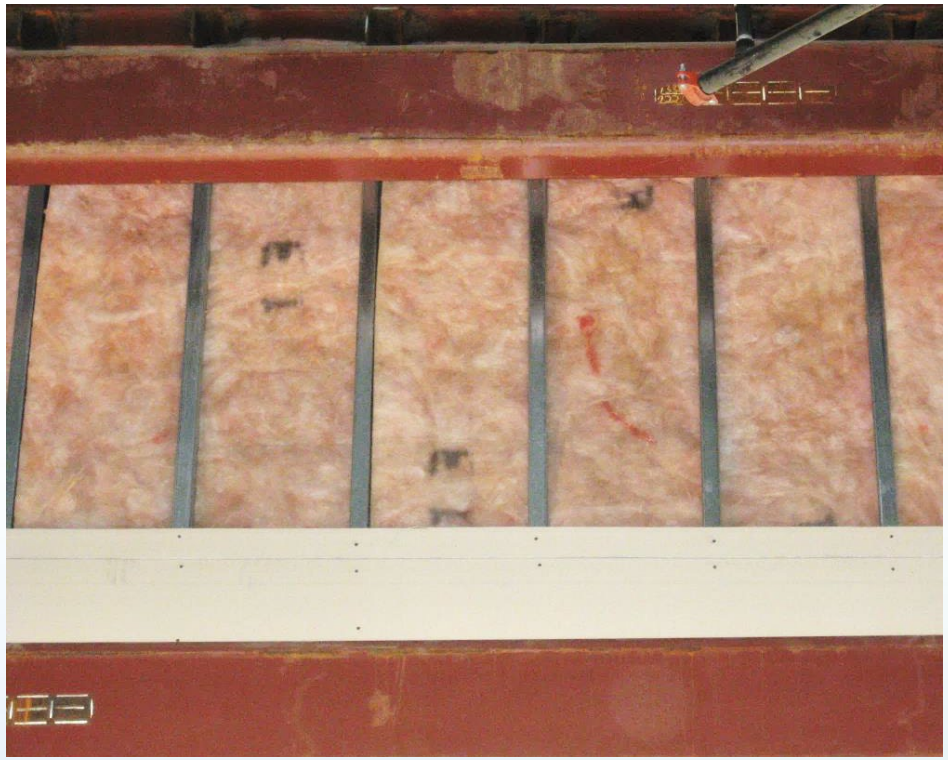
New for 2022

Ceiling insulation for vented attics

- Climate zones 1-4, 8-16 assembly U-factor 0.020 or R-49
  - Exception: climate zones 1, 3, 4, 9 with existing R-19 at ceiling
- Air seal all accessible areas of ceiling in climate zones 2, 11-16
  - Exceptions
    - Existing R-19 at ceiling
    - Atmospherically vented combustion appliances in dwelling unit
- Recessed luminaires must be insulated in climate zones 1-4, 8-16
  - Exception: climate zones 1-4, 8-10 with existing R-19 at ceiling
- Attic ventilation comply per CBC requirements
- Additional exceptions
  - R-38 existing insulation installed at ceiling
  - Alteration would disturbance asbestos, unless made in conjunction abatement
  - Knob and tube wiring located in attic
  - Accessible attic space not large enough to accommodate R-value, entire accessible space shall be filled with insulation and comply with § 806.3 of Title 24, Part 2.5.
  - Attic space above altered dwelling unit is shared with other dwelling units and § 180.2(b)1Bi not triggered for other dwelling units

Test Your Knowledge

Multifamily

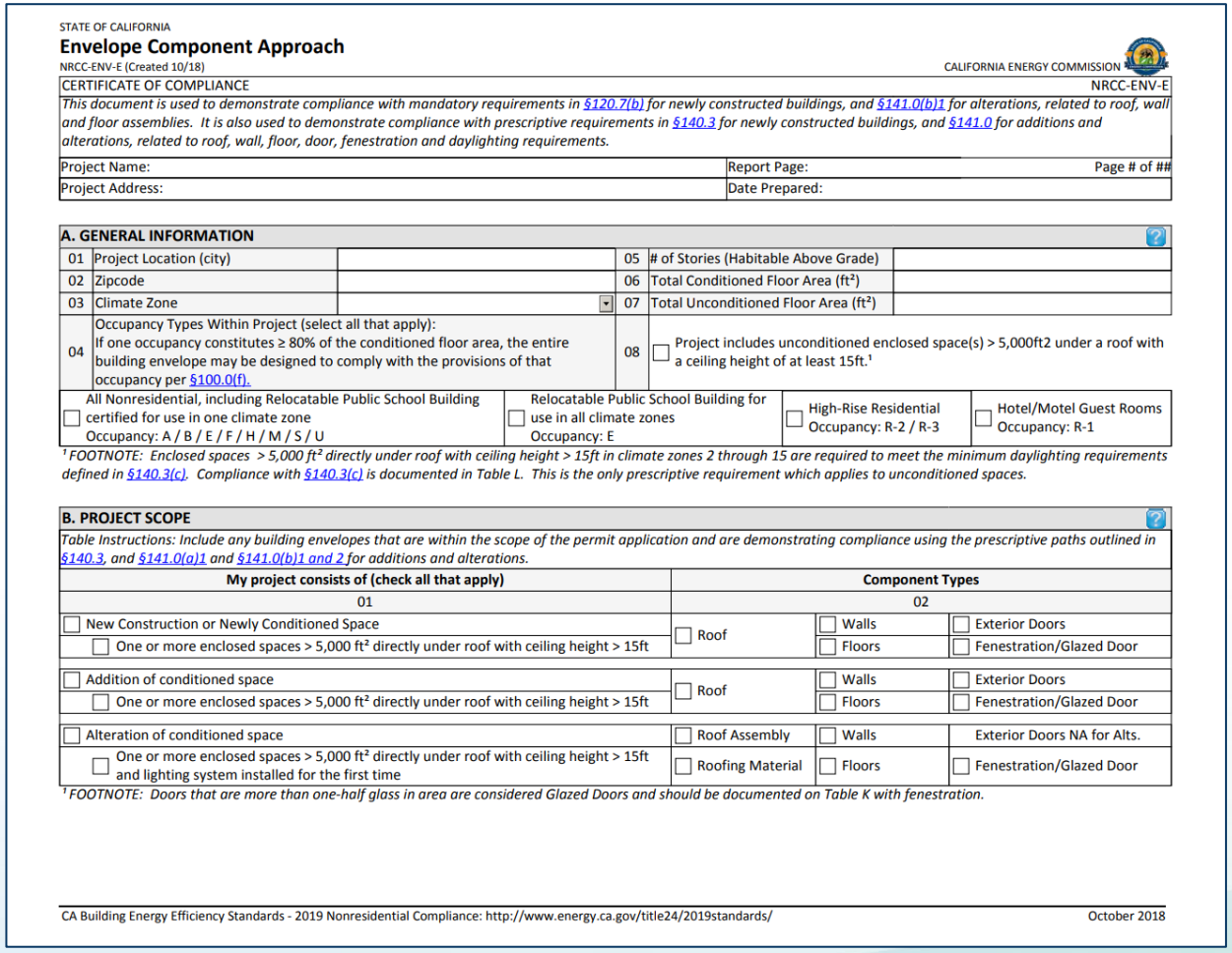


Is QII required for high rise multifamily projects?

No, QII is only required for low-rise multifamily projects in climates zones 1-6 and 8-16

- Prescriptive
- Not easy to trade-off

Plans Examiners



STATE OF CALIFORNIA

Envelope Component Approach

NRCC-ENV-E (Created 10/18) — CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE	NRCC-ENV-E

This document is used to demonstrate compliance with mandatory requirements in §120.7(b) for newly constructed buildings, and §141.0(b)1 for alterations, related to roof, wall and floor assemblies. It is also used to demonstrate compliance with prescriptive requirements in §140.3 for newly constructed buildings, and §141.0 for additions and alterations, related to roof, wall, floor, door, fenestration and daylighting requirements.

Project Name:	Report Page: Page # of ##
Project Address:	Date Prepared:

A. GENERAL INFORMATION

01	Project Location (city)		05	# of Stories (Habitable Above Grade)	
02	Zipcode		06	Total Conditioned Floor Area (ft²)	
03	Climate Zone		07	Total Unconditioned Floor Area (ft²)	
04	Occupancy Types Within Project (select all that apply): If one occupancy constitutes ≥ 80% of the conditioned floor area, the entire building envelope may be designed to comply with the provisions of that occupancy per §100.0(f).		08	☐ Project includes unconditioned enclosed space(s) > 5,000ft2 under a roof with a ceiling height of at least 15ft.[1]	

☐ All Nonresidential, including Relocatable Public School Building certified for use in one climate zone Occupancy: A / B / E / F / H / M / S / U	☐ Relocatable Public School Building for use in all climate zones Occupancy: E	☐ High-Rise Residential Occupancy: R-2 / R-3	☐ Hotel/Motel Guest Rooms Occupancy: R-1

[1] FOOTNOTE: Enclosed spaces > 5,000 ft² directly under roof with ceiling height > 15ft in climate zones 2 through 15 are required to meet the minimum daylighting requirements defined in §140.3(c). Compliance with §140.3(c) is documented in Table L. This is the only prescriptive requirement which applies to unconditioned spaces.

B. PROJECT SCOPE

Table Instructions: Include any building envelopes that are within the scope of the permit application and are demonstrating compliance using the prescriptive paths outlined in §140.3, and §141.0(a)1 and §141.0(b)1 and 2 for additions and alterations.

My project consists of (check all that apply)	Component Types		
01	02		
☐ New Construction or Newly Conditioned Space	☐ Roof	☐ Walls	☐ Exterior Doors
☐ One or more enclosed spaces > 5,000 ft² directly under roof with ceiling height > 15ft		☐ Floors	☐ Fenestration/Glazed Door
☐ Addition of conditioned space	☐ Roof	☐ Walls	☐ Exterior Doors
☐ One or more enclosed spaces > 5,000 ft² directly under roof with ceiling height > 15ft		☐ Floors	☐ Fenestration/Glazed Door
☐ Alteration of conditioned space	☐ Roof Assembly	☐ Walls	Exterior Doors NA for Alts.
☐ One or more enclosed spaces > 5,000 ft² directly under roof with ceiling height > 15ft and lighting system installed for the first time	☐ Roofing Material	☐ Floors	☐ Fenestration/Glazed Door

[1] FOOTNOTE: Doors that are more than one-half glass in area are considered Glazed Doors and should be documented on Table K with fenestration.

CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance: http://www.energy.ca.gov/title24/2019standards/ — October 2018

- Prescriptive or performance approach
  - Performance mandatory requirements for insulation
- Verify LMCC/NRCC values match plans
- Verify required values wall, roof, floor assemblies

Multifamily LMCC-PRF

CERTIFICATE OF COMPLIANCE - LOWRISE MULTIFAMILY MIXED USE PERFORMANCE COMPLIANCE METHOD

E1. HERS VERIFICATION 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.

Building-level Verifications:
- Quality insulation installation (QII)
- Indoor air quality ventilation
- Kitchen range hood

Cooling System Verifications:
- Minimum Airflow
- Verified Refrigerant Charge
- Fan Efficacy Watts/CFM

Heating System Verifications:
- -- None --

HVAC Distribution System Verifications:
- Duct leakage testing
- Ducts located entirely in conditioned space confirmed by duct leakage testing

Domestic Hot Water System Verifications:
- -- None --

F1. 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 (%)
15.7	n/a	Standard (14-17%)	Fixed	none	true	150-270	n/a	n/a	<=7:12	96	98

Field Inspectors

At rough frame

- Air sealing

At insulation stage

- Wall insulation values
- Raised floor insulation values

At final

- Ceiling insulation values
- LMCI/NRCI forms
- LMCV for QII

Roof Requirements
Multifamily

Administrative § 10-113

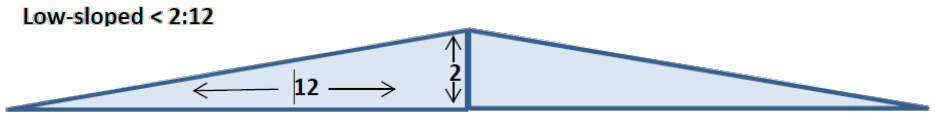
Mandatory § 110.8(i)

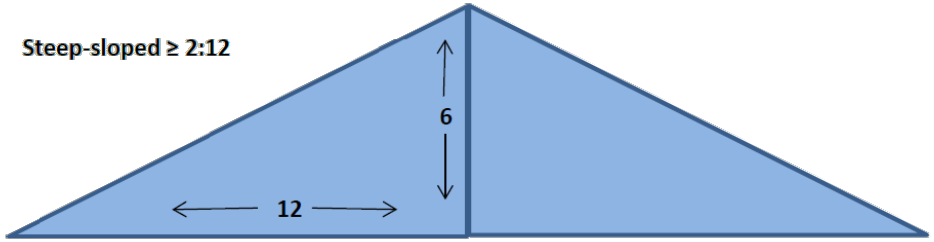
Prescriptive § 170.2(a)1A

Additions and Alterations § 180.2

Roof Definitions

All buildings § 100.1





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

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

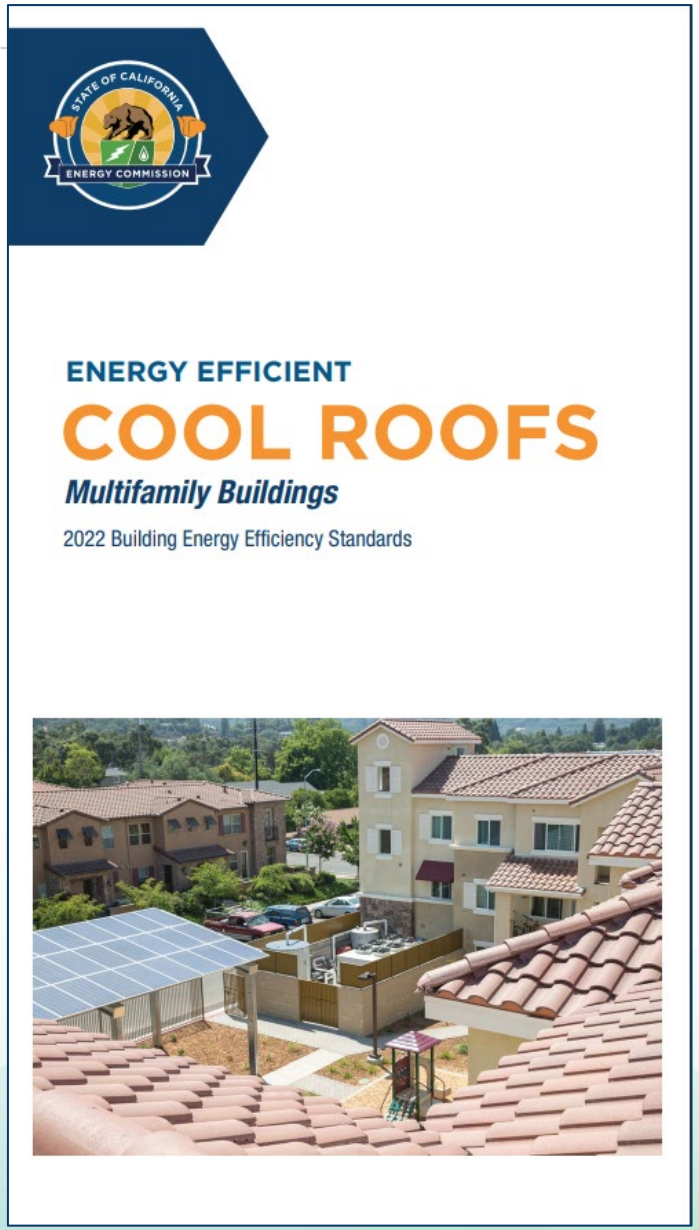
Solar reflectance (SR) - ability to reflect solar energy from the sun back into the atmosphere

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

Multifamily Cool Roof Brochure

- Cool roofs reflect more sunlight and absorb less heat
- Roofing products must meet minimum solar reflectance and thermal emittance values for Energy Code compliance
- Higher values equal cooler roofs



Roofing Products Administrative Regulations

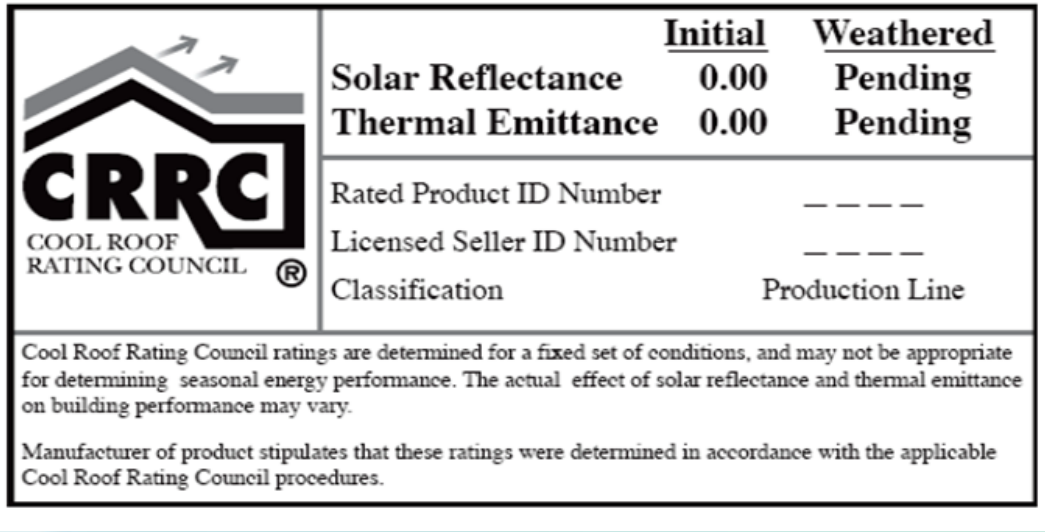
All buildings § 10-113

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 ®

	Initial	Weathered
Solar Reflectance	0.00	Pending
Thermal Emittance	0.00	Pending

Rated Product ID Number	_ _ _ _
Licensed Seller ID Number	_ _ _ _
Classification	Production Line

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.

Manufacturer of product stipulates that these ratings were determined in accordance with the applicable Cool Roof Rating Council procedures.

Roofing Products Mandatory Requirements

All buildings § 110.8(i)

Roofing products

- Meet aged solar reflectance and thermal emittance thresholds
- Certified and labeled per § 10-113
- CEC default values for non-certified products
- SRI may be used as alternative to aged SR and TE values
  - SRI worksheet
  - Allows for initial SR when aged SR is not available
- Liquid-applied roof coatings to meet Table 110.8-C for coverage and thickness requirements

Roofing Products Prescriptive Requirements

Multifamily § 170.2(a)1A

Roofing products

- Meet requirements in § 110.8
- Cool roof requirements by climate zone, roof slope, and attic type per Table 170.2-A
  - Minimum aged solar reflectance
  - Minimum thermal emittance
  - Exceptions
    - Building integrated photovoltaic panels and building integrated solar thermal panels
    - Roof constructions with weight of at least 25 pounds per ft²

Roofing Products Prescriptive Requirements

Multifamily § 170.2(a)1Bii, Table 170.2-A

New for 2022

- Option B: Attic with below roof deck insulation

TABLE 170.2-A: Option B Roofing Products

	Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	0.63	NR
Low-sloped	Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR
Low-sloped	Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	75	NR	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
Steep-sloped	Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR
Steep-sloped	Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	16	16	16	16	16	16	NR

Roofing Products Prescriptive Requirements

Multifamily § 170.2(a)1Biii, Table 170.2-A

New for 2022

- Option C: Attic with ducts in conditioned space

TABLE 170.2-A: Option C Roofing Products

	Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	0.63	NR
Low-sloped	Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR
Low-sloped	Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	75	NR	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
Steep-sloped	Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR
Steep-sloped	Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	16	16	16	16	16	16	NR

Roofing Products Prescriptive Requirements

Multifamily § 170.2(a)1A, Table 170.2-A

Updated for 2022

- Option D: Non-attic roof

TABLE 170.2-A: Option D Roofing Products

	Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	0.63	0.63	0.63	NR	0.63	0.63	0.63	NR
Low-sloped	Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	0.75	NR
Low-sloped	Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	75	75	75	NR	75	75	75	NR
Steep-sloped	Aged Solar Reflectance	NR	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	NR
Steep-sloped	Thermal Emittance	NR	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	NR
Steep-sloped	Solar Reflectance Index (SRI)	NR	16	16	16	16	16	16	16	16	16	16	16	16	16	16	NR

Roofing Products Addition Requirements

Multifamily§ 180.1(a)

Addition - increase in conditioned floor area and volume

- Prescriptive
  - Added roof and ceiling assemblies must comply as new construction
- Performance
  - Addition alone complies
  - Option for existing, plus addition, plus alteration

Roof Alterations Prescriptive Requirements

Multifamily § 180.2(b)1A

Updated for 2022

Roof replacement, recover, or recoat

- More than 50% or 2,000 ft^2, whichever is less
- Updates climates zones for cool roofs

Roof Type	Climate Zone	Minimum Three-Year Aged Solar Reflectance	Minimum Thermal Emittance	Minimum SRI
Steep-sloped	4, 8-15	0.20	0.75	16
Low-sloped	2, 4, 6-15	0.63	0.75	75

Roof Alterations Prescriptive Requirements

Multifamily § 180.2(b)1A, Table 180.2-A

Updated for 2022

Roof replacement, recover, or recoat

- Exceptions for low-sloped roofs
  - Insulation trade-off for low-sloped roofs per Table 180.2-A
  - Roof area covered by building integrated photovoltaic panels or building integrated solar thermal panels
  - Roof constructions with weight of at least 25 pounds per ft^2

TABLE 180.2-A: Insulation Trade-off for Low-sloped Roofs

Minimum Aged Solar Reflectance	Roof Deck Continuous Insulation R- value (Climate Zones 6-7)	Roof Deck Continuous Insulation R-value (Climate Zones 2, 4, 8-15)
0.60	2	16
0.55	4	18
0.50	6	20
0.45	8	22
No requirement	10	24

Roof Alterations Prescriptive Requirements

Multifamily § 180.2(b)1A, Table 180.2-A

Updated for 2022

Roof replacement, recover, or recoat

- Exceptions for steep-sloped roofs
  - Ceiling insulation at least R-38 or U-factor 0.025
  - Radiant barrier per Section 170.2(a)1C
  - No ducts in attic in climate zones 2, 4, 9, 10, 12 and 14
  - Continuous insulation at roof deck R-2 or greater
  - Roof area covered by building integrated photovoltaic panels or building integrated solar thermal panels
  - Roof constructions with weight of at least 25 pounds per ft^2

Roof Alterations Prescriptive Requirements

Multifamily § 180.2(b)1Aiii

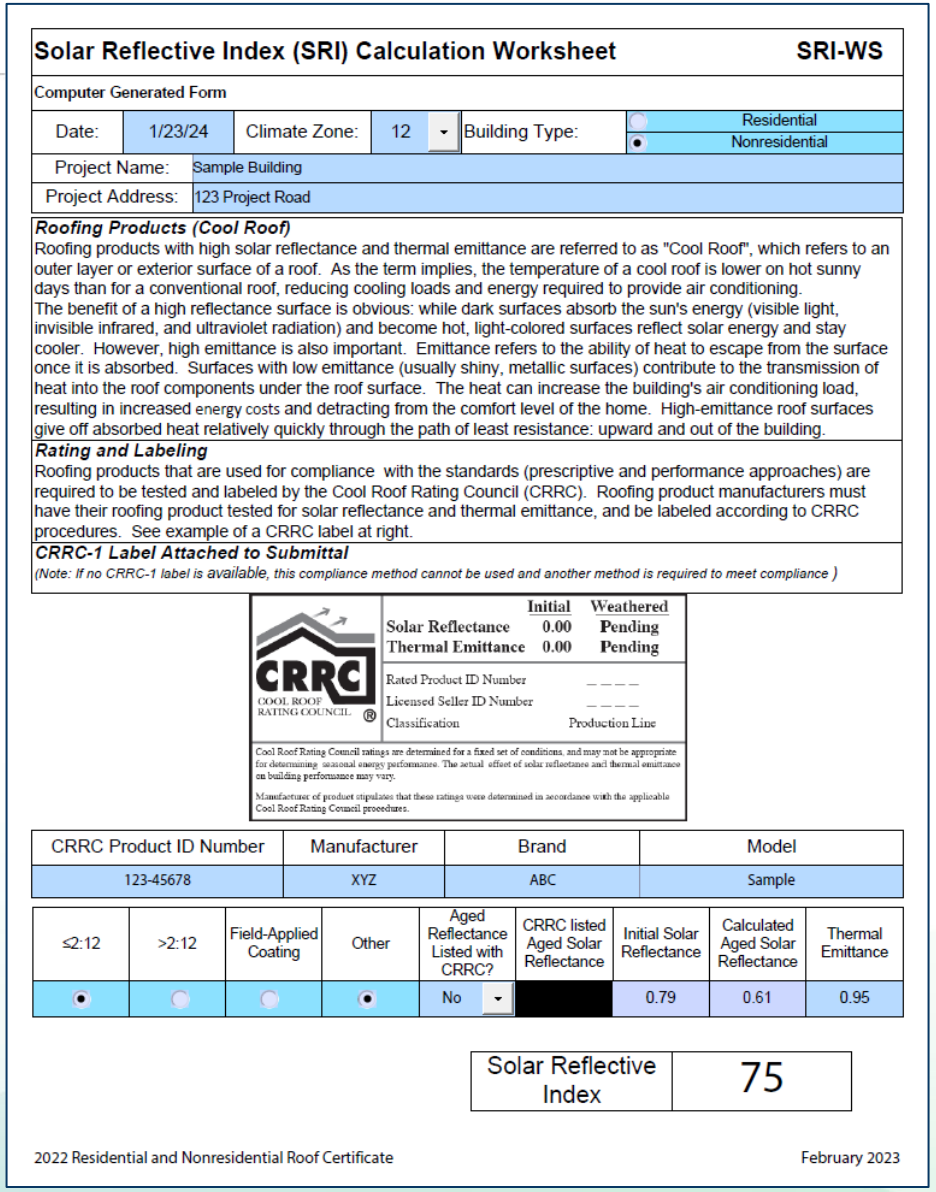
Updated for 2022

Area of roof replacements, recover, or recoat

- Adds above deck roof insulation for low-sloped roofs
  - Climate zones 1, 2, 4, 8-16
    - R-14 or U-factor 0.039
  - Exceptions
    - Roof recovers with new R-10 insulation added above deck
    - Existing mechanical equipment located on roof not disconnected and lifted, limited to R-10 or maximum allow per manufacturer
    - At drains and other low points, tapered insulation less than R-14, if average thermal resistance equals or exceeds R-14
    - Area of the roof recoat

Plans Examiners

- Verify required roof product values
  - Certain climate zones
  - SRI worksheet
- Verify LMCC/NRCC values match plans



Solar Reflective Index (SRI) Calculation Worksheet **SRI-WS**

Computer Generated Form

Date:	1/23/24	Climate Zone:	12	Building Type:	○ Residential ● Nonresidential
Project Name:	Sample Building				
Project Address:	123 Project Road				

Roofing Products (Cool Roof)

Roofing products with high solar reflectance and thermal emittance are referred to as "Cool Roof", which refers to an outer layer or exterior surface of a roof. As the term implies, the temperature of a cool roof is lower on hot sunny days than for a conventional roof, reducing cooling loads and energy required to provide air conditioning.
The benefit of a high reflectance surface is obvious: while dark surfaces absorb the sun's energy (visible light, invisible infrared, and ultraviolet radiation) and become hot, light-colored surfaces reflect solar energy and stay cooler. However, high emittance is also important. Emittance refers to the ability of heat to escape from the surface once it is absorbed. Surfaces with low emittance (usually shiny, metallic surfaces) contribute to the transmission of heat into the roof components under the roof surface. The heat can increase the building's air conditioning load, resulting in increased energy costs and detracting from the comfort level of the home. High-emittance roof surfaces give off absorbed heat relatively quickly through the path of least resistance: upward and out of the building.

Rating and Labeling

Roofing products that are used for compliance with the standards (prescriptive and performance approaches) are required to be tested and labeled by the Cool Roof Rating Council (CRRC). Roofing product manufacturers must have their roofing product tested for solar reflectance and thermal emittance, and be labeled according to CRRC procedures. See example of a CRRC label at right.

CRRC-1 Label Attached to Submittal

(Note: If no CRRC-1 label is available, this compliance method cannot be used and another method is required to meet compliance)

CRRC COOL ROOF RATING COUNCIL ®

	Initial	Weathered
Solar Reflectance	0.00	Pending
Thermal Emittance	0.00	Pending
Rated Product ID Number		_ _ _ _
Licensed Seller ID Number		_ _ _ _
Classification		Production Line

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.

Manufacturer of product stipulates that these ratings were determined in accordance with the applicable Cool Roof Rating Council procedures.

CRRC Product ID Number	Manufacturer	Brand	Model
123-45678	XYZ	ABC	Sample

≤2:12	>2:12	Field-Applied Coating	Other	Aged Reflectance Listed with CRRC?	CRRC listed Aged Solar Reflectance	Initial Solar Reflectance	Calculated Aged Solar Reflectance	Thermal Emittance
●	○	○	●	No		0.79	0.61	0.95

Solar Reflective Index	75

2022 Residential and Nonresidential Roof Certificate February 2023

Multifamily LMCC-PRF

CERTIFICATE OF COMPLIANCE - LOWRISE MULTIFAMILY MIXED USE PERFORMANCE COMPLIANCE METHOD	
Lowrise Multifamily Mixed Use Performance Compliance Method	**(Page 9 of 18)**

C8. ENERGY USE INTENSITY (EUI)

	Standard Design (kBtu/ft^2 / yr)	Proposed Design (kBtu/ft^2 / yr)	Margin (kBtu/ft^2 / yr)	Margin Percentage
GROSS EUI[1]	19.16	19.16	0	0
NET EUI[1]	7.74	7.69	0.05	0.65

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

D2. MULTIFAMILY REQUIRED SPECIAL FEATURES

- Indoor air quality, balanced fan
- IAQ Ventilation System Heat Recovery: minimum 67 SRE and 72 ASRE
- IAQ Ventilation System: supply outside air inlet, filter, and H/ERV cores accessible per RACM Reference Manual
- IAQ Ventilation System: fault indicator display
- Cool roof
- Non-standard duct location (any location other than attic)
- Northwest Energy Efficiency Alliance (NEEA) rated heat pump water heater; specific brand/model, or equivalent, must be installed

Field Inspectors

CRRC
COOL ROOF
RATING COUNCIL ®

	Initial	Weathered
Solar Reflectance	0.20	Pending
Thermal Emittance	0.75	Pending

Rated Product ID Number	_ _ _ _
Licensed Seller ID Number	_ _ _ _
Classification	Production Line

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.

Manufacturer of product stipulates that these ratings were determined in accordance with the applicable Cool Roof Rating Council procedures.

At rough frame verify

- Cool roof in certain climate zones

At final verify

- LMCI/NRCI installation forms

Fenestration and Exterior Door Requirements

Multifamily

Administrative § 10-111, § 10-112

Mandatory § 100.1, § 110.6, 160.1(e)

Prescriptive § 170.2(a)3

Additions and Alterations § 180.2

Fenestration Definitions

All buildings § 100.1

- **Fenestration product** - a transparent or translucent material plus any sash, frame, mullions, and dividers in façade of a building
- **Glazed door** - an exterior door having a glazed area of 25 percent or greater of the area of the door
- **U-factor** - overall coefficient of thermal transmission through the fenestration
- **Solar heat gain coefficient (SHGC)** - the ratio of solar heat gain entering the space through the fenestration which is released as heat into the space
- **Visible transmittance** - ratio of visible light transmitted through glazing, higher allows more light through window
- Additional updated definitions
  - *Clerestory, overhang projection, overhang rise*

Types of Fenestration

All buildings § 100.1

- Manufactured - pre-assembled glazing and frame
  - Commonly used in residential
- Site-built - field-assembled using factory products with the intent of being assembled on-site
  - Storefront or curtain wall system
- Field-fabricated - frame is made at the construction site of materials that were not pre-formed
  - Custom made at site for a specific application

NAFS Class AW

NAFS Performance Class AW (architectural windows)

- Meet AAMA/ WDMA/ CSA 101/ I.S.2/ A440 NAFS-2017 North American Fenestration Standard/ Specification
  - Air leakage resistance
  - Water penetration resistance
  - Uniform load resistance
  - Forced-entry resistance
- Significantly more expensive
- Architect calculates wind loads to determine if AW needed

Fenestration and Exterior Doors Administrative Regulations

All buildings §§ 10-111, 10-112

Labeling and certification requirements

- National Fenestration Rating Council (NFRC) is designated to administer certification program
- Temporary labels
  - NFRC manufactured window and door labels
  - CEC default table values
- Label certificates
  - NFRC Component Modeling Approach (CMA)
  - Reference Nonresidential Appendix NA6 alternate default procedure
- Permanent labels

Default tables

- CEC calculates, maintains, and revises

Fenestration Temporary Labels

NFRC

National Fenestration Rating Council®
CERTIFIED

World's Best Window Co.
Series "2000"
Casement
Vinyl-Clad Wood Frame
Double Glazing • Argon Fill • Low E
XYZ-X-1-00001-00001

ENERGY PERFORMANCE RATINGS

U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.22	0.23

ADDITIONAL PERFORMANCE RATINGS

Visible Transmittance	Air Leakage (U.S./I-P)
0.51	≤ 0.3

Manufacturer stipulates that these ratings conform the applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for 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

CEC default

2022 California Energy Commission Default Label
XYZ Manufacturing Co.

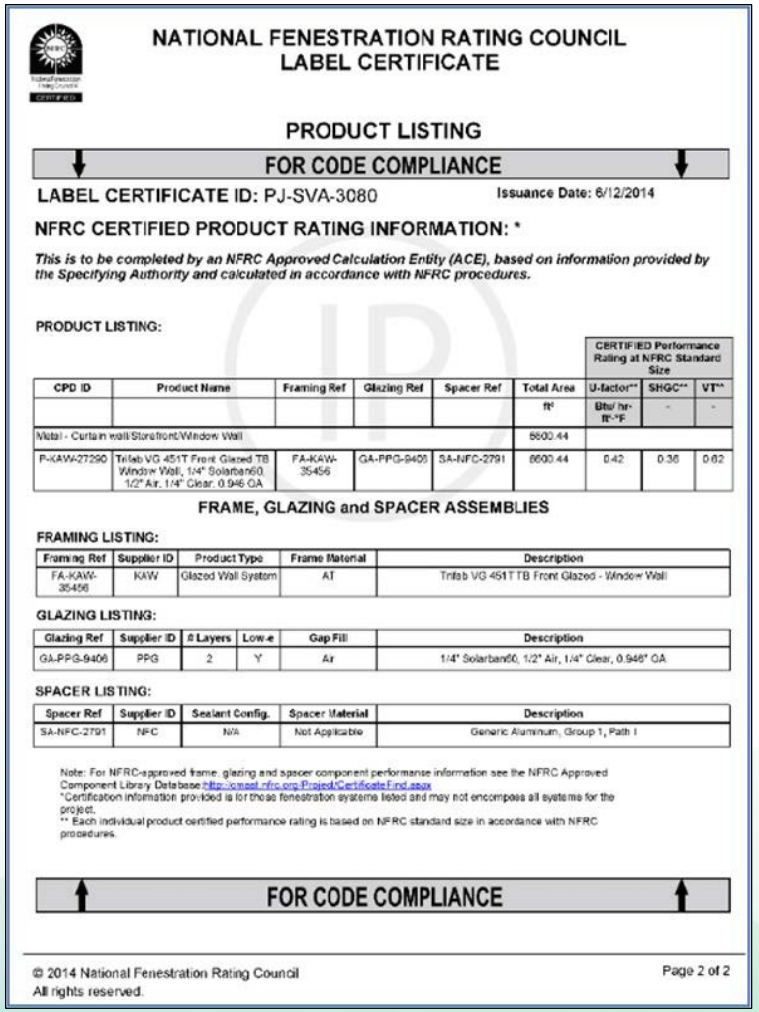
Key Features:	☐ Doors	☐ Double-Pane
	☐ Skylight	☐ Glass Block
Frame Type	**Product Type:**	**Product Glazing Type:**
☐ Metal	☐ Operable	☐ Clear
☐ Non-Metal	☐ Fixed	☐ Tinted
☐ Metal, Thermal Break	☐ Greenhouse/Garden Window	☐ Single-Pane
☐ Air space 7/16 in. or greater ☐ With built-in curb ☐ Meets Thermal-Break 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 2022 Energy Standards for Residential and Nonresidential Buildings.

NFRC CMA Label Certificate

Nonresidential Compliance Manual Section 3.3.5 C

- NFRC-approved components online libraries
  - Glazing, frame, spacer
- Ratings for various configurations
- Design windows, curtain wall systems, and skylights
- Determine if product meets energy code
- Compare energy performance of different designs



NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

PRODUCT LISTING

FOR CODE COMPLIANCE

LABEL CERTIFICATE ID: PJ-SVA-3080 Issuance Date: 6/12/2014

NFRC CERTIFIED PRODUCT RATING INFORMATION: *

This is to be completed by an NFRC Approved Calculation Entity (ACE), based on information provided by the Specifying Authority and calculated in accordance with NFRC procedures.

PRODUCT LISTING:

CPD ID	Product Name	Framing Ref	Glazing Ref	Spacer Ref	Total Area	CERTIFIED Performance Rating at NFRC Standard Size		
					ft²	U-factor** Btu/ hr-ft²-°F	SHGC** -	VT** -
Metal - Curtain wall/Storefront/Window Wall					8600.44			
P-KAW-27290	Trifab VG 451T Front Glazed TB Window Wall, 1/4" Solarban60, 1/2" Air, 1/4" Clear, 0.946 OA	FA-KAW-35456	GA-PPG-9406	SA-NFC-2791	8600.44	0.42	0.36	0.62

FRAME, GLAZING and SPACER ASSEMBLIES

FRAMING LISTING:

Framing Ref	Supplier ID	Product Type	Frame Material	Description
FA-KAW-35456	KAW	Glazed Wall System	Al	Trifab VG 451TTB Front Glazed - Window Wall

GLAZING LISTING:

Glazing Ref	Supplier ID	# Layers	Low-e	Gap Fill	Description
GA-PPG-9406	PPG	2	Y	Air	1/4" Solarban60, 1/2" Air, 1/4" Clear, 0.946" OA

SPACER LISTING:

Spacer Ref	Supplier ID	Sealant Config.	Spacer Material	Description
SA-NFC-2791	NFC	N/A	Not Applicable	Generic Aluminum, Group 1, Path I

Note: For NFRC-approved frame, glazing and spacer component performance information see the NFRC Approved Component Library Database (http://cmast.nfrc.org/Project/CertificateFind.aspx)
* Certification information provided is for those fenestration systems listed and may not encompass all systems for the project.
** Each individual product certified performance rating is based on NFRC standard size in accordance with NFRC procedures.

FOR CODE COMPLIANCE

Fenestration and Exterior Door Mandatory Requirements

All buildings § 110.6(a)

Manufactured and site-built

- Certified by NFRC
  - Air leakage (0.3 cfm)
  - U-factor
  - SHGC
  - Visual transmittance
- Exterior doors only require air leakage and U-factor
- No NFRC rating - use CEC default values

Site-built

- NA6 alternate default fenestration procedure
  - Single-family and low-rise multifamily
    - Up to 250 square feet
  - Nonresidential and high-rise multifamily
    - Only skylights up to 200 square feet
- Nonresidential and multifamily meet acceptance requirements in NA7.4

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 <41 ft†	1/2 Lite <90 ft†	3/4 Lite <110 ft†	Full Lite >110 ft†
2/A1/na/AIR/0.250	0.23 —	0.30 —	0.36 0.33	0.40 0.40
2/A1/.020(3)/ARG/0.750	0.21 —	0.24 —	0.26 0.31	0.28 0.36
2/A1/na/AIR/0.675	0.23 —	0.28 —	0.33 0.34	0.34 0.40
3/SS/na/AIR/0.250	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 83.24 † square inches

www.nfrc.org

Fenestration and Exterior Door Mandatory Requirements

All buildings § 110.6(b)

Field-fabricated

- Must use CEC default values
  - U-factor in Table 110.6-A
  - SHGC in Table 110.6-B
- Exterior doors less than 25% glazing use CEC default values
  - U-factor in 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

- NA6 only allowed
  - Single-family and low-rise multifamily vertical and skylights up to 250 ft^2
  - Nonresidential and high-rise multifamily skylights up to 200 ft^2

	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	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
Metal	Fixed	1.19	0.71	0.72
Metal	Greenhouse or garden window	2.26	1.40	N.A.
Metal	Glazed doors	1.25	0.77	N.A.
Metal	Skylight	1.98	1.30	N.A.
Metal, thermal break	Operable	N.A.	0.66	N.A.
Metal, thermal break	Fixed	N.A.	0.55	N.A.
Metal, thermal break	Greenhouse or garden window	N.A.	1.12	N.A.
Metal, thermal break	Glazed Doors	N.A.	0.59	N.A.
Metal, thermal break	Skylight	N.A.	1.11	N.A.
Nonmetal	Operable	0.99	0.58	0.60
Nonmetal	Fixed	1.04	0.55	0.57
Nonmetal	Glazed Doors	0.99	0.53	N.A.
Nonmetal	Greenhouse or garden window	1.94	1.06	N.A.
Nonmetal	Skylight	1.47	0.84	N.A.

Fenestration Default SHGC

All buildings Table 110.6-B

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

Exterior Door Default U-factor

Reference Joint Appendix JA4.5

Table 4.5.1 – Doors

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

Fenestration Mandatory Requirements

Multifamily § 160.1(e)

Updated for 2022

Fenestration products

- Maximum U-factor 0.58
- All climate zones
- Area-weighted average allowed
- Exceptions to U-factor requirement
  - Fenestration area up to 0.5% of conditioned floor area (CFA)
  - Greenhouse or garden windows up to 30 square feet of fenestration area

Fenestration Prescriptive Requirements

Multifamily § 170.2(a)3A-B

Updated for 2022

- **Exterior vertical windows**
  - Meet U-factor, SHGC, and VT requirements of Table 170.2-A
    - Shading use relative SHGC calculation Equation 170.2-A
- Vertical fenestration and glazed doors by window and floor area
  - Maximum 20% window to conditioned floor area
  - Maximum 40% window to gross exterior wall area
- Total skylights maximum 5% gross roof area
  - Atria over 55 feet high maximum 10% gross roof area

Fenestration Prescriptive Requirements

Multifamily § 170.2(a)3A, Table 170.2-A

New for 2022

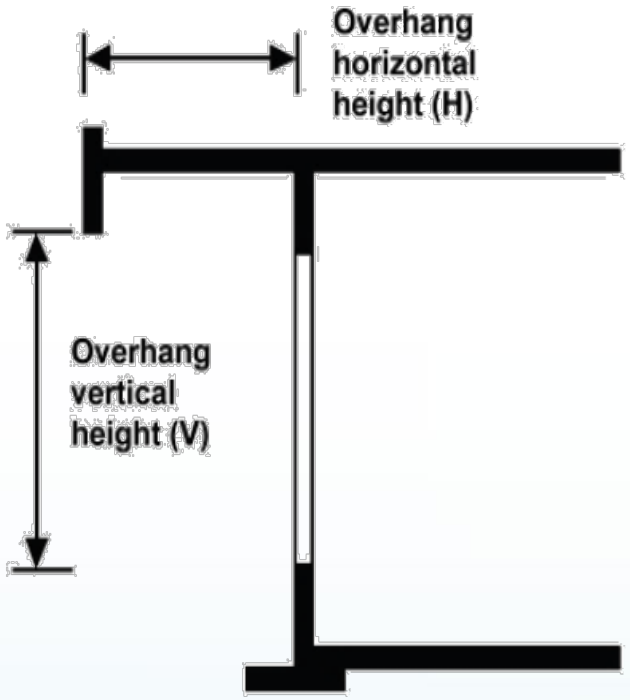
- Updated efficiencies for U-factor, SHGC, and VT
- By product type and number of habitable stories

	Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Curtainwall or Storefront	Maximum U-factor	0.38	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.38
Curtainwall or Storefront	Maximum RSHGC three or less habitable stories	NR	0.26	NR	0.26	NR	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.26	NR
Curtainwall or Storefront	Maximum RSHGC four or more habitable stories	0.35	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.26	0.25
Curtainwall or Storefront	Minimum VT four or more habitable stories	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
NAFS 2017 Performance Class AW[5]	Maximum U-factor	0.38	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.38
NAFS 2017 Performance Class AW[5]	Maximum RSHGC three or less habitable stories	NR	0.24	NR	0.24	NR	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	NR
NAFS 2017 Performance Class AW[5]	Maximum RSHGC four or more habitable stories	0.35	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
NAFS 2017 Performance Class AW[5]	Minimum VT four or more habitable stories	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
All Other Fenestration	Maximum U-factor	0.30	0.30	0.30	0.30	0.30	0.30	0.34	0.34	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
All Other Fenestration	Maximum RSHGC three or less habitable stories	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
All Other Fenestration	Maximum RSHGC, four or more habitable stories	0.35	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23

Fenestration Prescriptive Requirements

Multifamily § 170.2(a)3Aiii

Updated for 2022



Shading on exterior vertical windows

- Relative SHGC (RSHGC) calculation
- Recognizes external shading
  - Overhangs
  - Horizontal slats
- Equation 170.2-A
  - RSHGC = SHGC × [1 + a × (2.72-PF – 1) × (sin(b × Az) + c)]

Exterior Door Prescriptive Requirements

Multifamily § 170.2(a)4, Table 170.2-A

Exterior doors

- Meet U-factor of Table 170.2-A
- Less than 25% glazing

TABLE 170.2-A Exterior Door Maximum U-Factors For Multifamily Buildings

Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Dwelling Unit Entry	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
Common Use Area Entry Non-Swinging	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50
Common Use Area Entry Swinging	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

Daylighting Prescriptive Requirements

Multifamily § 170.2(b)

Large enclosed spaces greater than 5,000 ft² in climate zones 2-15

- Conditioned or unconditioned
- Ceilings greater than 15 feet height directly under roof

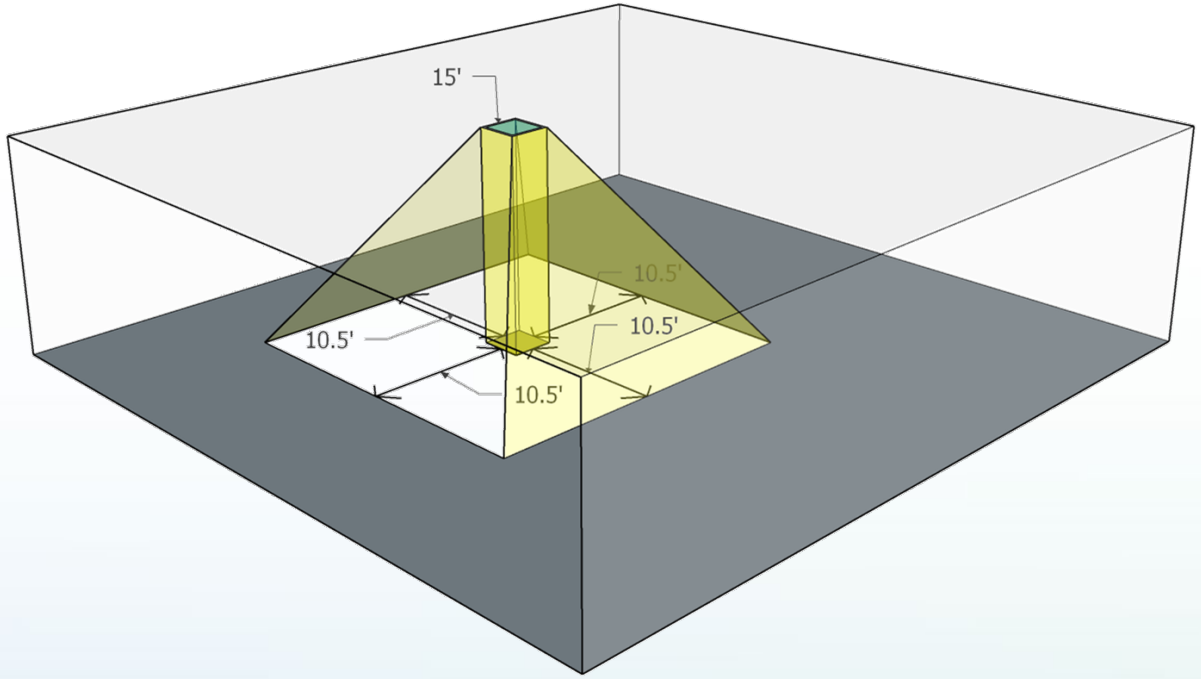
Requirements

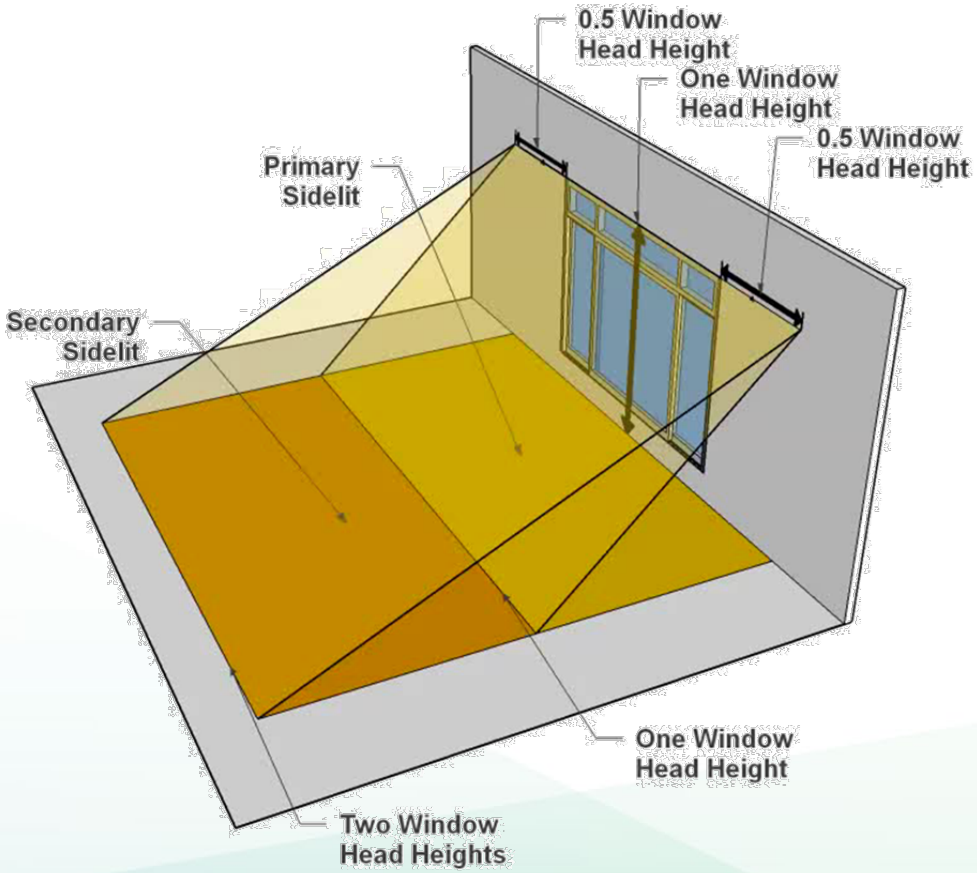
- At least 75% of floor area within skylit daylit zone or primary sidelit daylit zone
- Shown on plans
- Daylighting controls per § 160.5(b)4D
- Skylight area at least 3% of floor area or calculate with higher VT to install less skylight area (minimum 1.5%)
- Haze value greater than 90%

Daylighting Prescriptive Requirements

Multifamily § 170.2(b)

Skylit and sidelit areas



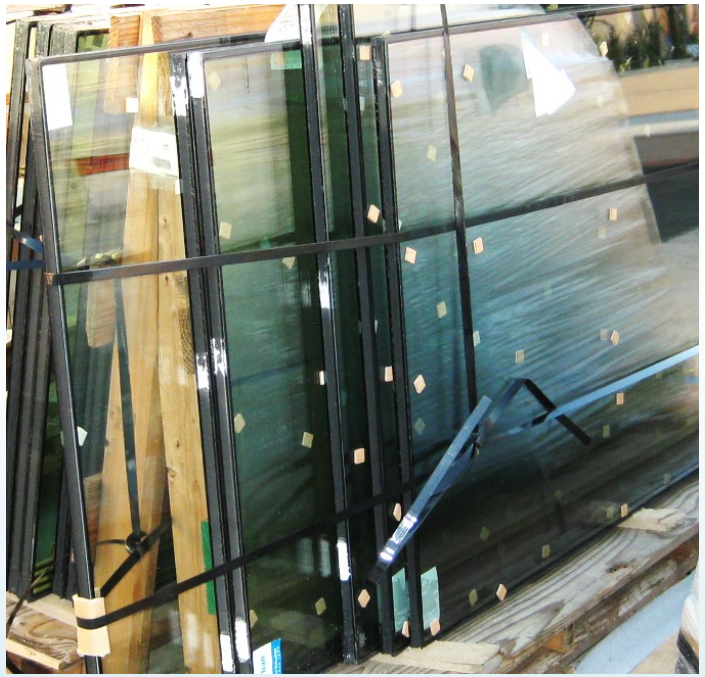


Fenestration Prescriptive Requirements

Multifamily Additions § 180.1(a)1

Addition - increase in conditioned floor area and volume

- Added windows, skylights, doors
- Must comply as new construction
- Additions 700 ft^2 or less
  - U-factor, SHGC and VT in Table 180.2-B



Fenestration Prescriptive Requirements

Multifamily Alterations § 180.2(b)1C-D

Replacing existing fenestration meet either

- Meet U-factor, SHGC, and VT requirements in Table 180.2-B
- Area-weighted U-factor and SHGC of Table 170.2-A
- If replacing 150 ft^2 or less of vertical glazing, meet U-factor only

Adding fenestration to existing building

- Meet total fenestration area per 170.2(a)
- Meet U-factor, SHGC, and VT requirements in Table 180.2-B
- Adding 50 ft^2 or less is exempt
- Up to 16 ft^2 of new skylight are per dwelling unit meet U-factor 0.55 and SHGC 0.30

Adding exterior doors meet U-factor per 170.2(a)4

Fenestration Alteration Requirements

Multifamily Table 180.2-B

	Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Curtainwall / Storefront / Window Wall and Glazed Doors[1]	U-factor	0.38	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.38
Curtainwall / Storefront / Window Wall and Glazed Doors[1]	RSHGC	0.35	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25
Curtainwall / Storefront / Window Wall and Glazed Doors[1]	VT[2]	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
NAFS 2017 Performance Class AW Window – Fixed[1]	U-factor	0.38	0.38	0.38	0.38	0.38	0.47	0.47	0.41	0.41	0.38	0.38	0.38	0.38	0.38	0.38	0.38
NAFS 2017 Performance Class AW Window – Fixed[1]	RSHGC	0.35	0.25	0.25	0.25	0.25	0.31	0.31	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25
NAFS 2017 Performance Class AW Window – Fixed[1]	VT[2]	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
NAFS 2017 Performance Class AW Window –Operable[1]	U-factor	0.43	0.43	0.43	0.43	0.43	0.47	0.47	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
NAFS 2017 Performance Class AW Window –Operable[1]	RSHGC	0.35	0.24	0.24	0.24	0.24	0.31	0.31	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
NAFS 2017 Performance Class AW Window – Operable[1]	VT[2]	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
All Other Windows and Glazed Doors[1]	U-factor	0.30	0.30	0.30	0.30	0.30	0.30	0.34	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
All Other Windows and Glazed Doors[1]	RSHGC	0.35	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23

Fenestration Alteration Requirements

Multifamily Table 180.2-B

	Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Skylights, 3 habitable stories and fewer	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
Skylights, 3 habitable stories and fewer	RSHGC	NA	0.23	NA	0.23	NA	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	NA
Skylights, 4 habitable stories and greater	U-factor	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Skylights, 4 habitable stories and greater	RSHGC	0.35	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Skylights, 4 habitable stories and greater	VT[2]	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49

Footnotes to TABLE 180.2-B

1. For fenestration installed in buildings with three or fewer habitable stories, there is no SHGC requirement in Climate Zones 1, 3, 5, and 16.
2. Minimum VT requirements to not apply to multifamily buildings 3 habitable stories or less.

Check Your Understanding

Photo courtesy of Marvin Windows and Doors

When does an exterior door become fenestration?

When the door has 25% or more glass

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

Plans Examiners

- Verify required windows and skylights values
- Verify total fenestration areas
- Verify required door values
- Verify daylighting devices
- Verify LMCC or NRCC values match plans

G7B. FENESTRATION SUMMARY (MULTIFAMILY AND COMMON AREAS)

01	02	03	04	05	06	07	08	09	10	11	12	13
Fenestration Name	Fenestration Type/ Product Type / Frame Type	Parent Surface	Azimuth	Multiplier	Area (ft^2)	Overall U-factor	U-factor Source	Overall SHGC	SHGC Source	Overall VT	Exterior Shading	Status[2]
Zone1WinFront	Vertical fenestration Architectural Window - Operable (Multifamily only) N/A	Zone1WallFront	0	10	164.7	0.3	NFRC	0.23	NFRC	N/A	Standard bug screens	N
Zone1WinLeft	Vertical fenestration Architectural Window - Operable (Multifamily only) N/A	Zone1WallLeft	90	2	40.5	0.3	NFRC	0.23	NFRC	N/A	Standard bug screens	N
Zone1WinBack	Vertical fenestration Architectural Window - Operable (Multifamily only) N/A	Zone1WallBack	180	10	164.7	0.3	NFRC	0.23	NFRC	N/A	Standard bug screens	N
Zone1WinRight	Vertical fenestration Architectural Window - Operable (Multifamily only) N/A	Zone1WallRight	270	2	40.5	0.3	NFRC	0.23	NFRC	N/A	Standard bug screens	N
Zone2WinFront	Vertical fenestration Architectural Window - Operable (Multifamily only) N/A	Zone2WallFront	0	10	164.7	0.3	NFRC	0.23	NFRC	N/A	Standard bug screens	N
Zone2WinLeft	Vertical fenestration Architectural Window - Operable (Multifamily only) N/A	Zone2WallLeft	90	2	40.5	0.3	NFRC	0.23	NFRC	N/A	Standard bug screens	N
Zone2WinBack	Vertical fenestration Architectural Window - Operable (Multifamily only) N/A	Zone2WallBack	180	10	164.7	0.3	NFRC	0.23	NFRC	N/A	Standard bug screens	N

Field Inspectors

At rough frame verify

- Window and skylight values
- Total fenestration area
- Daylighting features

At final verify

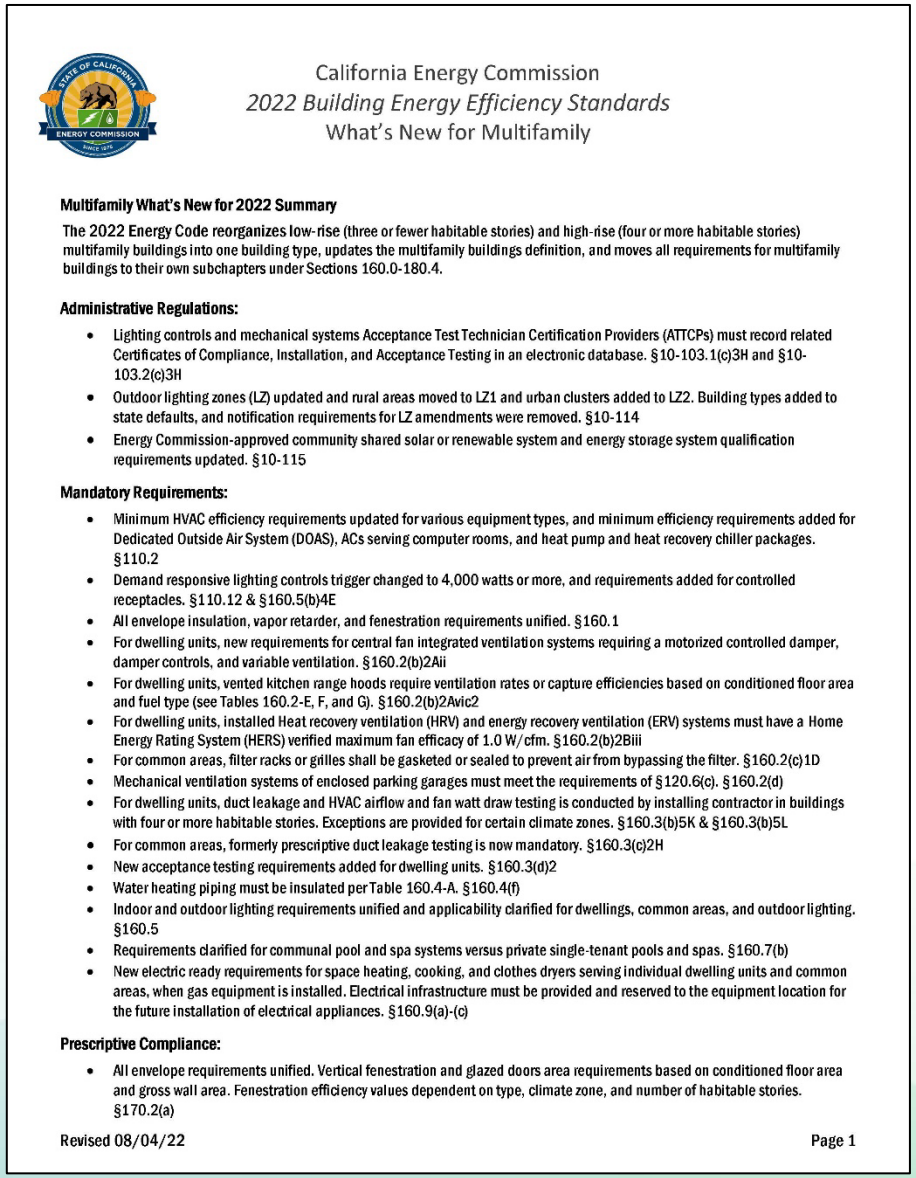
- LMCI or NRCI installation forms
- NRCA acceptance forms

Resources

Multifamily Summary

What's New for Multifamily

- Summary of significant changes
- Code references
- Download from the Online Resource Center



California Energy Commission
2022 Building Energy Efficiency Standards
What's New for Multifamily

Multifamily What's New for 2022 Summary

The 2022 Energy Code reorganizes low-rise (three or fewer habitable stories) and high-rise (four or more habitable stories) multifamily buildings into one building type, updates the multifamily buildings definition, and moves all requirements for multifamily buildings to their own subchapters under Sections 160.0-180.4.

Administrative Regulations:

- Lighting controls and mechanical systems Acceptance Test Technician Certification Providers (ATTCPs) must record related Certificates of Compliance, Installation, and Acceptance Testing in an electronic database. §10-103.1(c)3H and §10-103.2(c)3H
- Outdoor lighting zones (LZ) updated and rural areas moved to LZ1 and urban clusters added to LZ2. Building types added to state defaults, and notification requirements for LZ amendments were removed. §10-114
- Energy Commission-approved community shared solar or renewable system and energy storage system qualification requirements updated. §10-115

Mandatory Requirements:

- Minimum HVAC efficiency requirements updated for various equipment types, and minimum efficiency requirements added for Dedicated Outside Air System (DOAS), ACs serving computer rooms, and heat pump and heat recovery chiller packages. §110.2
- Demand responsive lighting controls trigger changed to 4,000 watts or more, and requirements added for controlled receptacles. §110.12 & §160.5(b)4E
- All envelope insulation, vapor retarder, and fenestration requirements unified. §160.1
- For dwelling units, new requirements for central fan integrated ventilation systems requiring a motorized controlled damper, damper controls, and variable ventilation. §160.2(b)2Aii
- For dwelling units, vented kitchen range hoods require ventilation rates or capture efficiencies based on conditioned floor area and fuel type (see Tables 160.2-E, F, and G). §160.2(b)2Avic2
- For dwelling units, installed Heat recovery ventilation (HRV) and energy recovery ventilation (ERV) systems must have a Home Energy Rating System (HERS) verified maximum fan efficacy of 1.0 W/cfm. §160.2(b)2Biii
- For common areas, filter racks or grilles shall be gasketed or sealed to prevent air from bypassing the filter. §160.2(c)1D
- Mechanical ventilation systems of enclosed parking garages must meet the requirements of §120.6(c). §160.2(d)
- For dwelling units, duct leakage and HVAC airflow and fan watt draw testing is conducted by installing contractor in buildings with four or more habitable stories. Exceptions are provided for certain climate zones. §160.3(b)5K & §160.3(b)5L
- For common areas, formerly prescriptive duct leakage testing is now mandatory. §160.3(c)2H
- New acceptance testing requirements added for dwelling units. §160.3(d)2
- Water heating piping must be insulated per Table 160.4-A. §160.4(f)
- Indoor and outdoor lighting requirements unified and applicability clarified for dwellings, common areas, and outdoor lighting. §160.5
- Requirements clarified for communal pool and spa systems versus private single-tenant pools and spas. §160.7(b)
- New electric ready requirements for space heating, cooking, and clothes dryers serving individual dwelling units and common areas, when gas equipment is installed. Electrical infrastructure must be provided and reserved to the equipment location for the future installation of electrical appliances. §160.9(a)-(c)

Prescriptive Compliance:

- All envelope requirements unified. Vertical fenestration and glazed doors area requirements based on conditioned floor area and gross wall area. Fenestration efficiency values dependent on type, climate zone, and number of habitable stories. §170.2(a)

Revised 08/04/22 Page 1

Online Resource Center

www.energy.ca.gov/orc

Handouts
- Fact sheets
- Guides

Tools
- Checklists
- Blueprint newsletter

Training
- Presentations
- Videos

Links
- Internal resources
- External resources

HERS Program

HERS Program information

- 2022 Energy Code – CalCERTS approved
- Providers for 2019 Energy Code

CalCERTS, Inc. HERS PROVIDER

- Newly constructed buildings
- Additions
- Alterations of residential and nonresidential buildings
- California whole-house home energy ratings
- HERS building performance contractors

CHEERS

- Newly constructed buildings
- Additions
- Alterations of residential and nonresidential buildings

Blueprint Newsletter

Energy Code quarterly newsletter

- Updates
- Clarifications
- Frequently asked questions

Issue 144 | October - December 2023

BLUEPRINT

CALIFORNIA ENERGY COMMISSION

EFFICIENCY DIVISION

In This Issue

For additional help with the Energy Code, see Energy Code Ace's **online offerings** of trainings, tools, and resources.

2025 Energy Code Update: Draft Regulations

The **2025 Energy Code** will improve upon the 2022 Energy Code by updating energy efficiency standards for newly constructed buildings, additions, and alterations to existing buildings, consistent with state and federal law. During pre-rulemaking California Energy Commission (CEC) staff evaluated proposed revisions to the 2025 Energy Code and prepared draft regulations (known as **Express Terms**). During the rulemaking in 2024, the CEC will have 45-day and 15-day public comments periods. The final 2025 Energy Code language will be proposed for adoption after the public comment periods in 2024 for an anticipated publication in 2025, with an effective date of January 1, 2026.

Summary of Staff Proposed Changes

- Introduces heat pump standards for existing single-family homes and for designated types of existing nonresidential buildings
- Updates heat pump standards for newly constructed single-family, multifamily, and designated types of nonresidential building
- Updates photovoltaic system standards for newly constructed buildings
- Updates energy storage standards for high-rise multifamily, nonresidential, and hotel and motel buildings
- Increases envelope efficiency standards
- Increases space conditioning system efficiency and control standards
- Improves indoor air quality requirements for multifamily buildings
- Improves efficiency standards for multifamily domestic water heating systems
- Establishes electric-ready requirements for multifamily domestic water heating systems
- Simplifies standards for multifamily buildings
- Increases efficiency requirements for pool and spa water heating systems

1

Stay Connected

Receive Energy Code updates

- Subscribe to Efficiency Division emails
  - Appliances
  - Blueprint
  - Building Standards
- Respond to confirmation email

Follow the California Energy Commission

Energy Code Hotline

Monday through Friday

- 8:00 a.m. to 12:00 p.m.
- 1:00 p.m. to 4:30 p.m.

Call

- 800-772-3300 in CA
- 916-654-5106 outside CA

Email

- Title24@energy.ca.gov

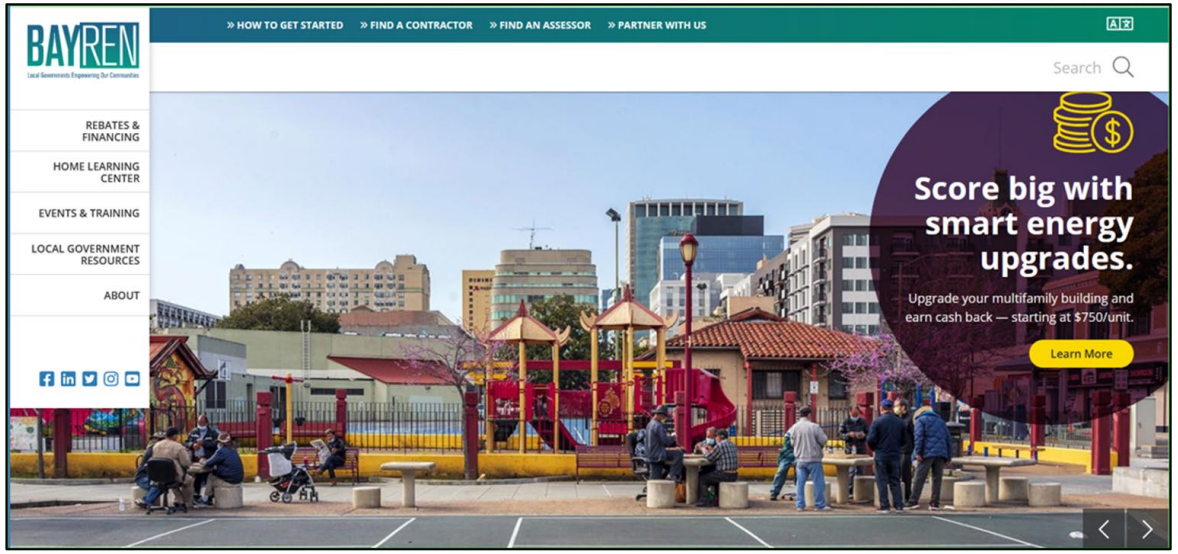
Compliance Software Support

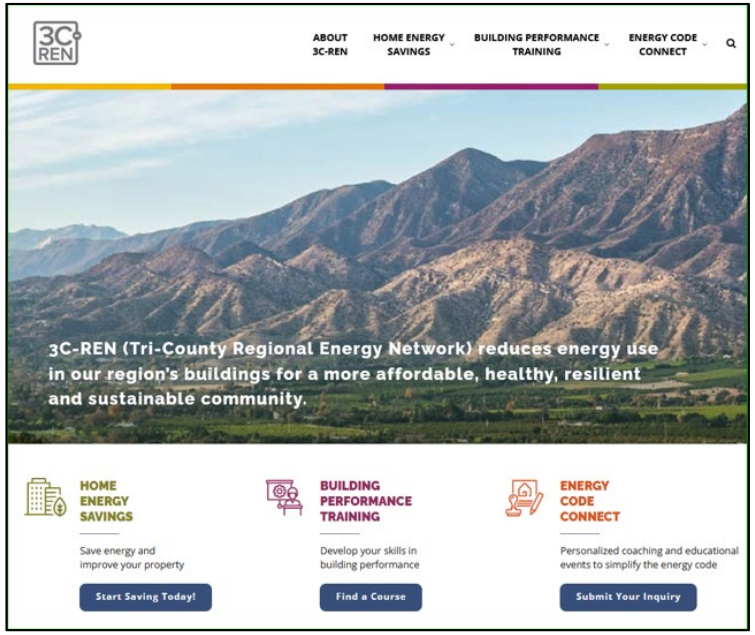
Email

- Nonresidential and multifamily software
  - CBECC@energy.ca.gov
- Single-family residential software
  - CBECC.Res@energy.ca.gov

Energy Code Ace

Local RENs


BAYREN
» HOW TO GET STARTED
» FIND A CONTRACTOR
» FIND AN ASSESSOR
» PARTNER WITH US
Search
REBATES & FINANCING
HOME LEARNING CENTER
EVENTS & TRAINING
LOCAL GOVERNMENT RESOURCES
ABOUT
Score big with smart energy upgrades.
Upgrade your multifamily building and earn cash back — starting at $750/unit.
Learn More


3C REN
ABOUT 3C-REN
HOME ENERGY SAVINGS
BUILDING PERFORMANCE TRAINING
ENERGY CODE CONNECT
3C-REN (Tri-County Regional Energy Network) reduces energy use in our region's buildings for a more affordable, healthy, resilient and sustainable community.
HOME ENERGY SAVINGS
Save energy and improve your property
Start Saving Today!
BUILDING PERFORMANCE TRAINING
Develop your skills in building performance
Find a Course
ENERGY CODE CONNECT
Personalized coaching and educational events to simplify the energy code
Submit Your Inquiry


I-REN
ABOUT
PROGRAMS
EVENTS / CALENDAR
CONTACT US
Search...
Public Sector Program
Workforce Education & Training Program
Codes & Standards Program
INLAND REGIONAL ENERGY NETWORK
The Inland Regional Energy Network (I-REN) connects local governments, the workforce, and other stakeholders to a wide range of energy efficiency resources.


SoCalREN
Public Agencies
Residential
Financing
WE&T
About SoCalREN
LIMITED TIME ONLY: SoCalREN can cover up to 80% - 100% of heat pump water heater installation costs for projects completed this year! Learn More
10 YEARS
SoCalREN
Empowering
Sustainable Communities
Celebrating 10 Years of SoCalREN empowering sustainable communities by creating pathways toward a greener future.
Learn More
SoCalREN Programs
Whether you're a homeowner, multifamily property owner or manager, business owner, or public agency representative, the Southern California Regional Energy Network (SoCalREN), a service of the County of Los Angeles, can help you take advantage of a wide variety of energy efficiency opportunities that can help you save energy and money. Learn more by visiting the program of your choice below, and feel free to contact us with any questions.

New Resource Hub

Homeowners and renters

- Information about water and space heating, cooking, EV charging, incentives

Contractors

- Information about training, tools, incentives

Local government representatives

- Information about model policies, permitting, training, incentives

Links on the Building and Home Energy Resource Hub

Thank you