2022 Energy Code

Single-family Mechanical Overview

California Energy Commission
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Agenda

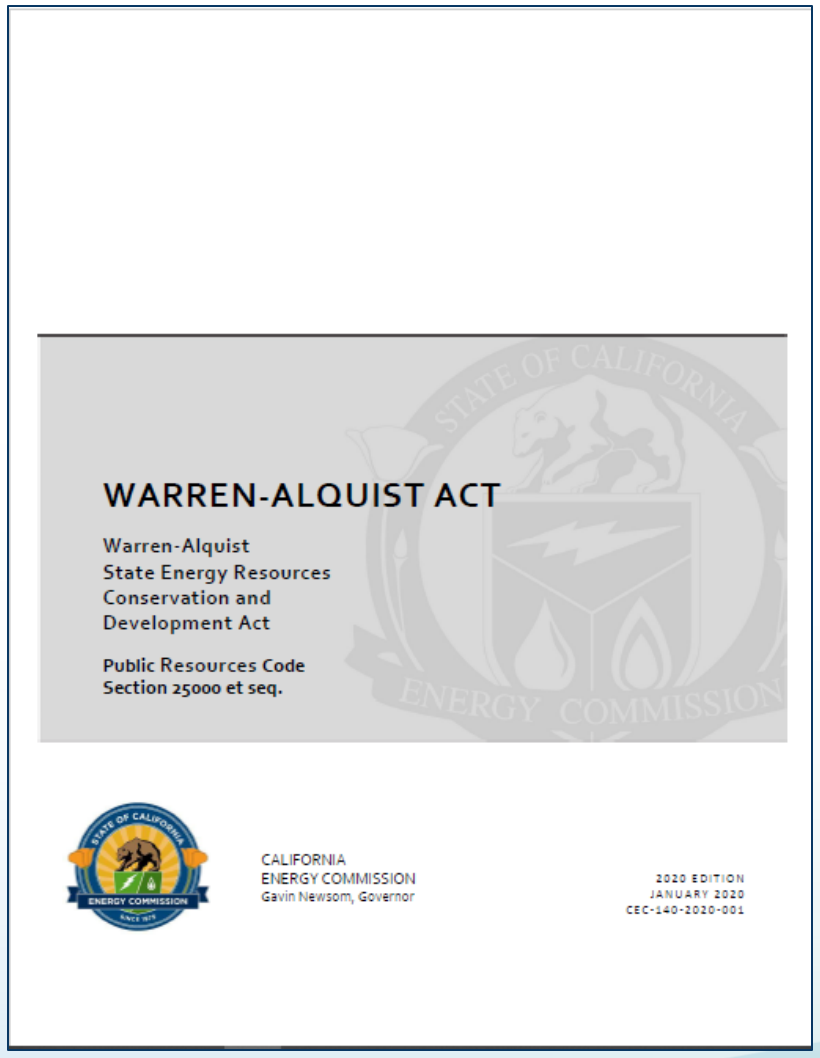
- Title 24, Part 6 Single-family HVAC Sections
- 2022 Energy Code basics and overview
- All occupancies - mandatory
- Single-family mechanical – mandatory
- Single-family mechanical – performance and prescriptive
- Single-family mechanical – additions and alterations
- Demonstrating Compliance Documentation - Forms
- Resources

Title 24, Part 6 Single-family HVAC Sections

Subchapter	Subchapter Title	Section	Section Title
2	**All Occupancies** - **Mandatory** Requirements for the Manufacture, Construction and Installation of Systems, Equipment, and Building Components	§110.1 §110.2 §110.5	Mandatory requirements for Appliances Mandatory requirements for Space-Conditioning Equipment Pilot Lights Prohibited
7	Single-family Residential Buildings - **Mandatory** Requirements	§150.0	Mandatory features and devices
8	Single-family Residential Buildings - **Performance and Prescriptive Compliance** Approaches	§150.1	Performance and Prescriptive Compliance Approaches
9	Single-family Buildings - **Additions, Alterations, and Repairs to existing residential buildings**	§150.2	Additions and alterations to existing Single-family

2022 Energy Code Basics

Energy Code History



Warren-Alquist Act established CEC in 1974

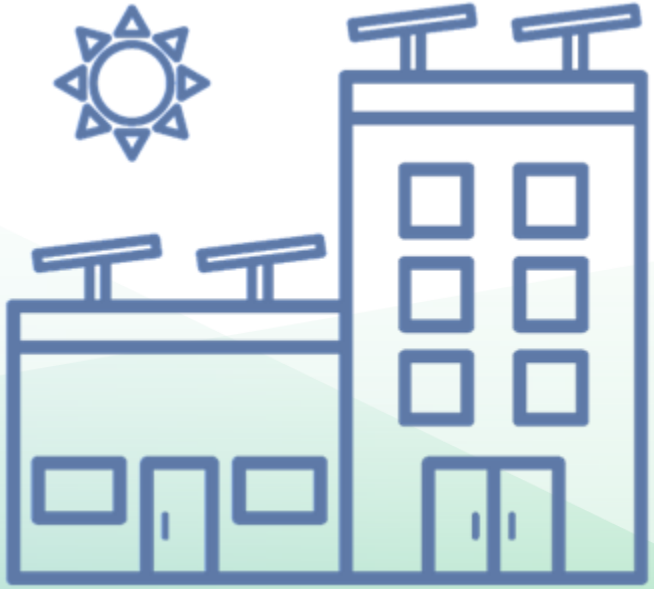
Authority to develop and maintain Building Energy Efficiency Standards (Energy Code)

Requires CEC to update periodically, usually every 3 years

Requires Energy Code to be cost-effective over economic life of building

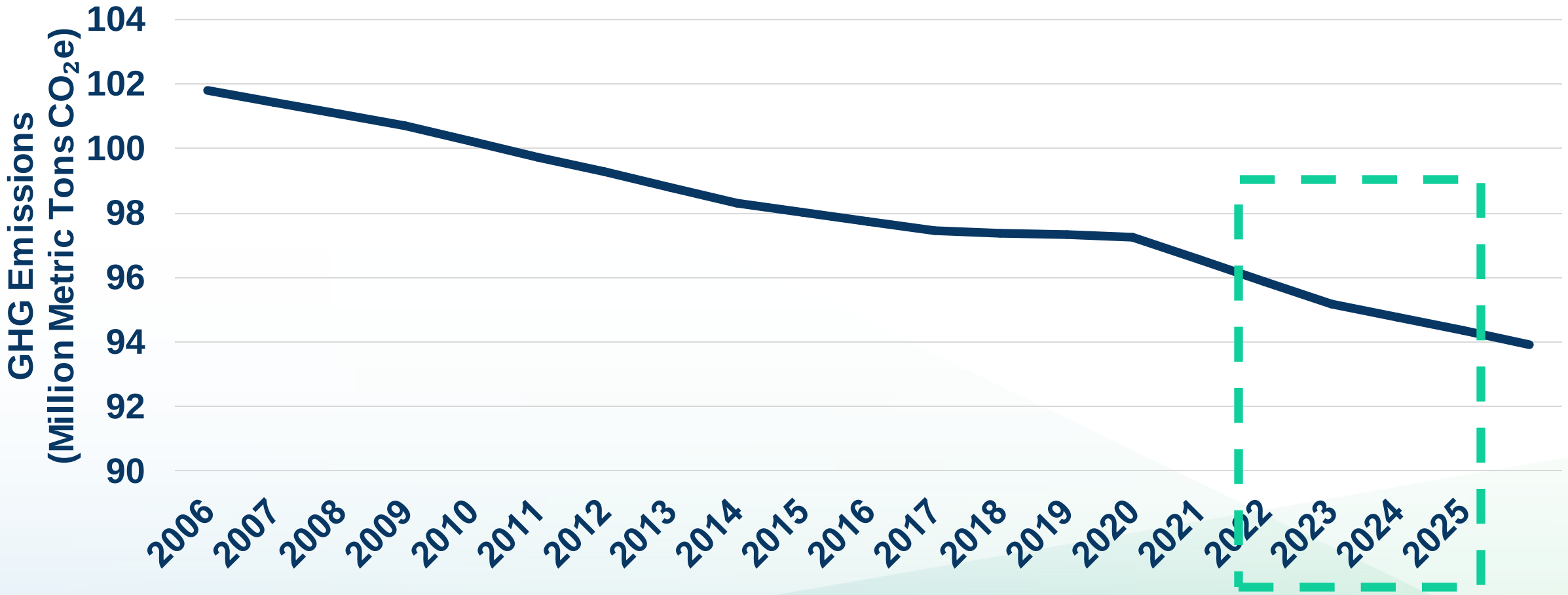
2022 Energy Code Goals

- 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

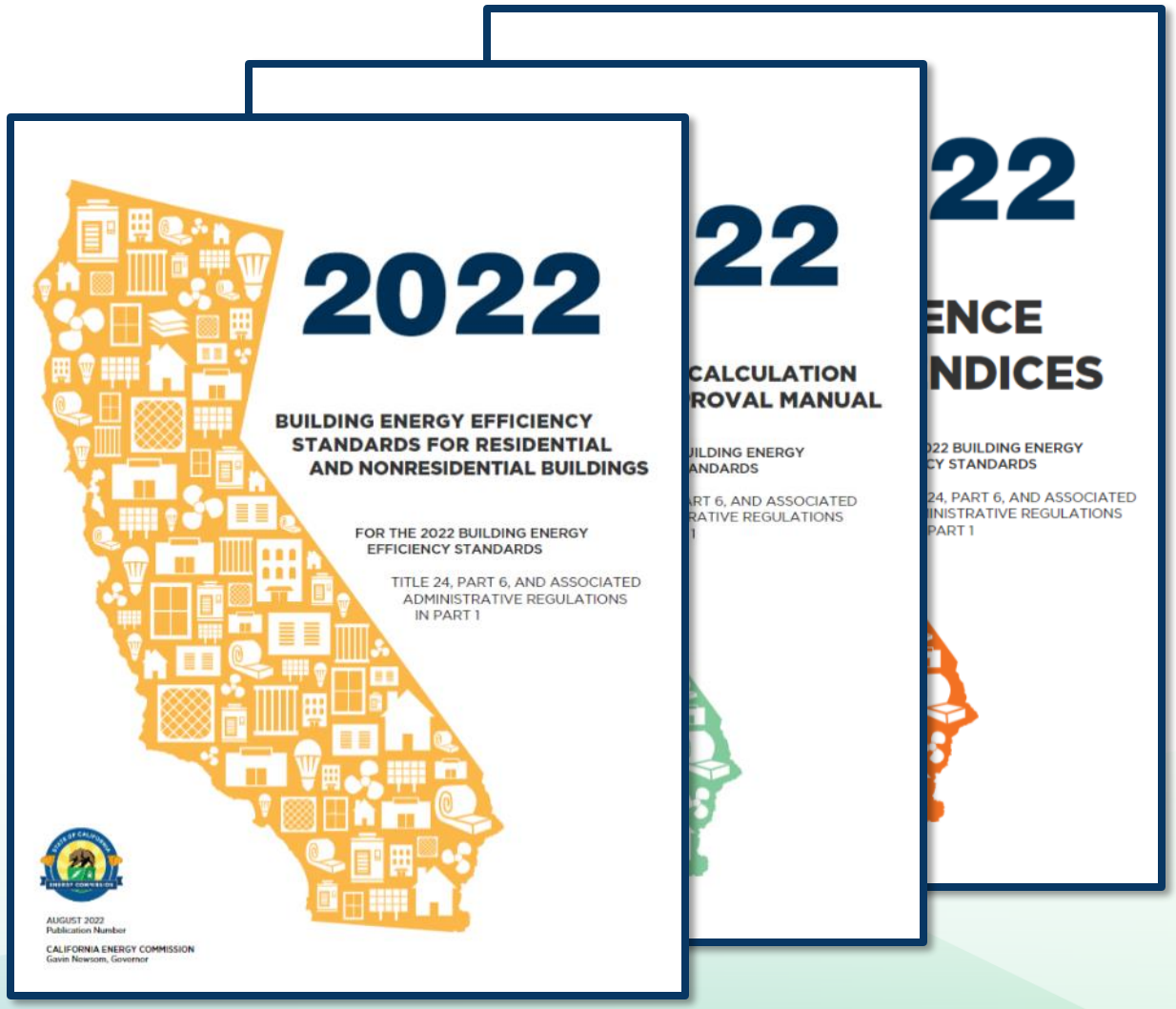


Source: CEC Impact Analysis 2005, 2008, 2013, 2016, 2019, 2022

2022 Energy Code

Effective January 1, 2023

- Building permit applications submitted on or after Jan 1, 2023
- Must use 2022 tools
  - Software
  - Forms

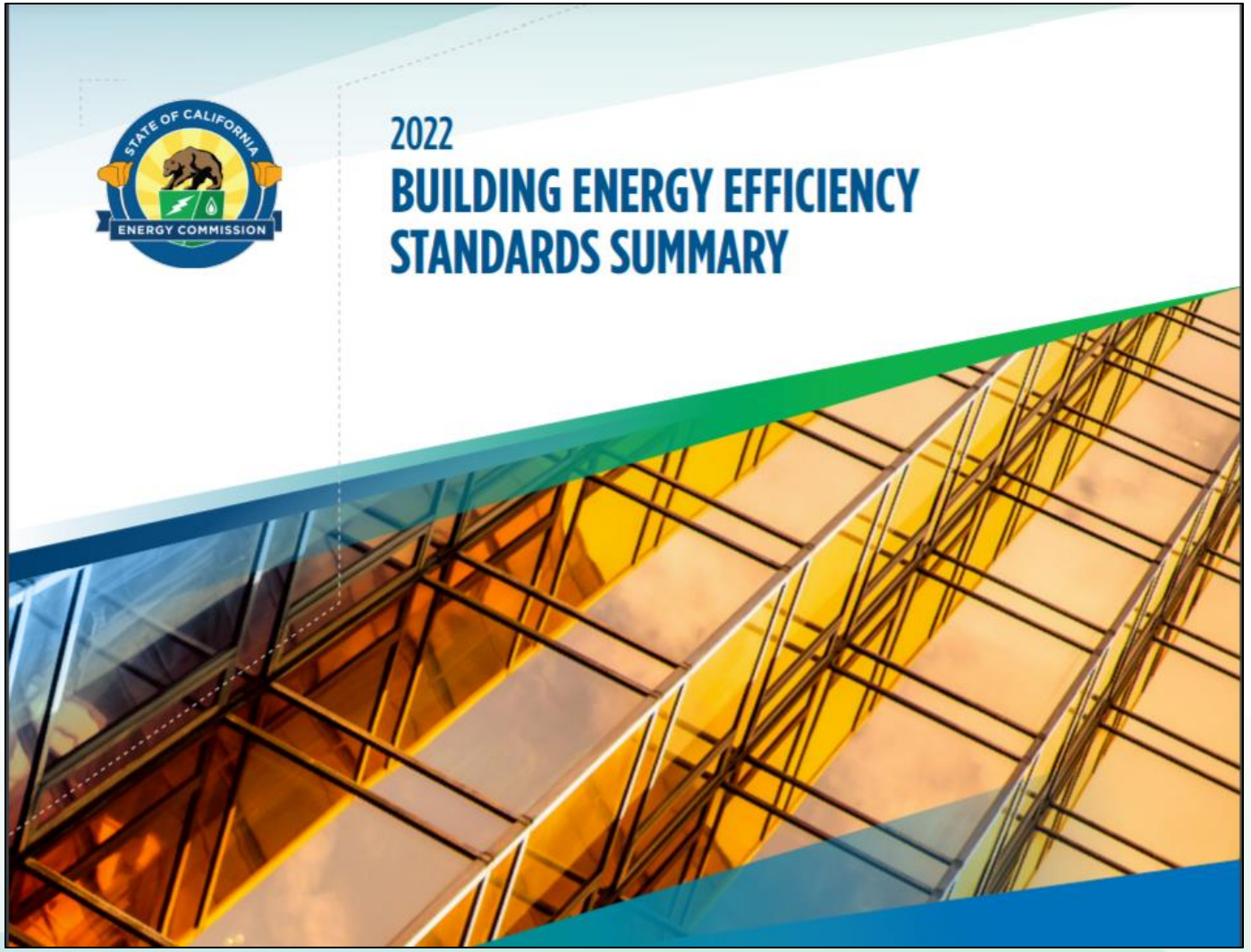


2022 Documents Online

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

2022 Energy Code Highlights

- Heat pump baselines
- Solar and battery storage
- Ventilation requirements
- Lighting
- Multifamily restructuring



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 exceed standard building design

2022 Performance Metrics

Energy performance calculations

Single-Family

- EDR1: hourly source energy
- EDR2: time dependent valuation (TDV)
  - Efficiency EDR2, PV + flexibility = total EDR2

Demonstrating Compliance

Compliance forms confirm Energy Code is met

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

Type of form	Single-family	Multifamily 3 or less habitable stories	Nonresidential Multifamily 4 or more habitable stories
Certificate of compliance	CF1R	LMCC	NRCC
Certificate of installation	CF2R	LMCI	NRCI
Certificate of verification	CF3R	LMCV	NRCV
Certificate of acceptance	-	-	NRCA

2022 Compliance Software

Performance approach must use approved compliance software versions

- Single-family
  - CBECC-Res 2022.3.0
  - EnergyPro 9.2
  - Right-Energy 2022.3.0

Single-family Defined

All Buildings § 100.1

Single-family building

- Occupancy group R-3
  - Two or less dwelling units
  - Not multifamily, hotel, or motel
- Townhouse
- Occupancy group R-3.1
- Occupancy group U on residential site

Subchapter 2 - All Occupancies

Mandatory §§ 110.0, 110.2, 110.5

All Occupancies - Mandatory HVAC Requirements

§110.1 - §110.5

- §110.1 - Mandatory Requirements for Appliances
- §110.2 - Mandatory Requirements for Space Conditioning Equipment
- §110.5 - Natural Gas Central Furnaces, Cooking Equipment, Pool and Spa Heaters, and Fireplaces: Pilot Lights Prohibited

Mandatory Requirements for Appliances

§110.1

- **Systems, equipment and appliances may be installed only if they are certified and listed as follows:**
  - Item covered by Title 20 must meet the Title 20 efficiency requirements and be listed in the Title 20 database (MAEDBS)
  - Items having efficiency requirements in Title 24, Part 6 must be listed in one of the following:
    - Title 20 database
    - Federal database
    - Approved trade association database
      - AHRI (Air Conditioning, Heating and Refrigeration Institute) or CTI (Cooling Technology Institute)
  - If the equipment cannot be listed, it must demonstrate efficiency conformance per Section 10-109 of Part 1

Mandatory Requirements for Space Conditioning Equipment

§110.2(a)

- All equipment in this section must be certified by the manufacturer.
- Equipment listed in TABLE 110.2-A through TABLE 110.2-N must meet the applicable efficiencies when tested per the listed test procedure.

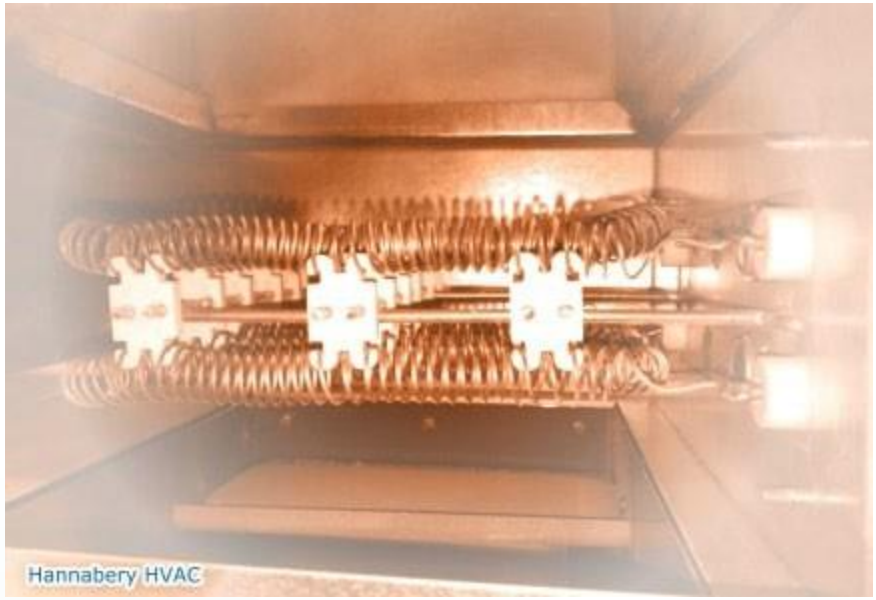
EXCEPTIONS:

- Some water chilling packages,
- Some positive displacement chillers and
- Equipment serving refrigerated warehouses or commercial refrigeration.
- See §110.2(a) for details.

Mandatory Requirements for Space Conditioning Equipment

§110.2(b)

- **Heat pumps with supplementary electric resistance heaters must have controls that do the following:**
  - Prevent supplementary heater operation when the heating load can be met by the heat pump alone
  - The cut-on and cut-off temperatures for the electric resistance heating must be lower than the heat pump cut-on and cut-off temperatures
- EXCEPTION:
  - There are exceptions for defrost, transient periods, and room air conditioners.



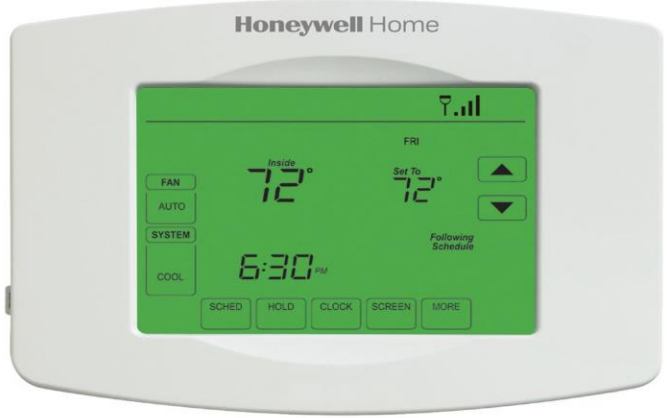
Source: https://www.hannabery.com/faq4.shtml

Mandatory Requirements for Space Conditioning Equipment

§110.2(c)

- **Thermostat Requirements**
  - Unitary systems without an EMCS must have setback thermostat that can be programmed with at least four temperature setpoints within 24 hours.
  - Thermostats for heat pumps must also control supplementary electric resistance heaters as discussed on the previous slide

- EXCEPTION:
  - Gravity gas wall heaters, gravity floor heaters, gravity room heaters, non-central electric heaters, fireplaces or decorative gas appliances, wood stoves, room air conditioners, and room air-conditioner heat pumps are not required to have setback thermostats.



Source: www.honeywellhome.com/us/en/products/air/thermostats/

Mandatory Requirements for Space Conditioning Equipment

§110.2(d)

- **Gas- and Oil-Fired Furnaces ≥ 225,000 Btu/h must have controls to limit Standby Loss:**
  - They must have an **intermittent ignition or interrupt device** (IID).
  - They must have either **power venting** or a **flue damper.**
  - A **vent damper** is permissible with furnaces using combustion air from the conditioned space.
  - All furnaces in unconditioned space must have **jacket heat losses** not exceeding 0.75 percent of the input rating.

Mandatory Requirements for Space Conditioning Equipment

§110.2(f)

- **Low leakage air handler compliance credit:**
  - The air handler must be listed on the Energy Commission's list of certified products.
  - System and attached ducts must be leak tested by a **HERS rater** and the documentation uploaded to the **HERS Registry**.
  - Credit is only available if the performance method is used.

Source: http://microcleanroom.com/air-handling-units.html

Natural Gas Central Furnaces, Cooking Equipment, Pool and Spa Heaters, and Fireplaces: Pilot Lights Prohibited

§110.5

- **Any natural gas system or equipment listed below may be installed only if it does not have a continuously burning pilot light:**
  - Fan-type central furnaces
  - Household cooking appliances
    - EXCEPTION: Household cooking appliances without an electrical supply voltage connection and each pilot consumes less than 150 Btu/hr
  - Pool heaters
  - Spa heaters
  - Indoor and outdoor fireplaces

Subchapter – 7
Single-family residential buildings

Mandatory § 150.0

Installation of fireplaces, decorative gas appliances and gas logs

§150.0(e)

Must comply with §110.5, §4.503 of Part 11 and have the following

- Closeable metal or glass doors covering the entire opening of the firebox.
- A combustion air intake to draw air from the outside
  - At least 6 square inches
  - equipped with a readily accessible, operable, and tight-fitting damper or combustion air control device

  Exception: An outside combustion-air intake is not required if the fireplace will be installed over concrete slab flooring and the fireplace will not be located on an exterior wall.
- A flue damper with a readily accessible control.

  Exception: When a gas log, log lighter or decorative gas appliance is installed in a fireplace, the flue damper must be blocked open if required by the CMC or the manufacturer's installation instructions.

Space-conditioning equipment

§§150.0(h)1,2

Building cooling and heating load

- Heating and cooling loads are determined by using either ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), SMACNA (Sheet Metal and Air Conditioning Contractors' National Association), or ACCA (Air Conditioning Contractors of America)
    - Heating systems must meet CBC minimum requirements

Design conditions

- Sizing HVAC
    - Indoor Temperatures (Heating: 68°F and Cooling: 75°F)
    - Outdoor Temperatures (Reference Joint Appendix JA2)

Space-conditioning equipment

§150.0(h)3

Outdoor condensing units

- Clearances
  - 5 feet from outlet of dryer vents

- Liquid line filter drier
  - when required by manufacturer

Space-conditioning equipment

§150.0(h)4, §150.0(i)

Central forced-air heating furnaces

- Temperature rise
  - Installations configured to operate with manufacturer inlet to outlet temperature rise specifications

Thermostats

- All heating or cooling systems, including heat pumps, not controlled by a central EMCS must have a setback thermostat, as specified in §110.2(c).

Space-conditioning equipment

§150.0(j)1B

Insulation for piping and tanks

- The following systems must meet requirements of Section 120.3(a).
  - Piping for space-conditioning systems,
  - Solar water-heating system collector loop,
  - Distribution piping for steam and hydronic heating system

Space-conditioning equipment

Table 120.3-A

Table 120.3-A PIPE INSULATION THICKNESS

Fluid Operating Temperature Range (°F)	Insulation Conductivity			Nominal Pipe Diameter (in inches)				
	Conductivity (in Btu·in/h·ft²·°F)	Mean Rating Temperature (°F)		< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
Space heating and Service Water Heating Systems (Steam, Steam Condensate, Refrigerant, Space Heating, Service Hot Water)				**Minimum Pipe Insulation Required (Thickness in inches or R-value)**				
Above 350	0.32-0.34	250	Inches	4.5	5.0	5.0	5.0	5.0
			R-value	R 37	R 41	R 37	R 27	R 23
251-350	0.29-0.32	200	Inches	3.0	4.0	4.5	4.5	4.5
			R-value	R 24	R 34	R 35	R 26	R 22
201-250	0.27-0.30	150	Inches	2.5	2.5	2.5	3.0	3.0
			R-value	R 21	R 20	R 17.5	R 17	R 14.5
141-200	0.25-0.29	125	Inches	1.5	1.5	2.0	2.0	2.0
			R-value	R 11.5	R 11	R 14	R 11	R 10
105-140	0.22-0.28	100	Inches	1.0	1.5	1.5	1.5	1.5
			R-value	R 7.7	R 12.5	R 11	R 9	R 8

Fluid Operating Temperature Range (°F)	Insulation Conductivity			Nominal Pipe Diameter (in inches)								
	Conductivity (in Btu·in/h·ft2·°F)	Mean Rating Temperature (°F)		< 1		1 to <1.5		1.5 to < 4	4 to < 8	8 and larger
Space cooling systems (chilled water, refrigerant and brine)				**Minimum Pipe Insulation Required (Thickness in inches or R-value)[1]**						
40-60	0.21-0.27	75	Inches	Nonres 0.5	Res 0.75	Nonres 0.5	Res 0.75	1.0	1.0	1.0
			R-value	Nonres R 3	Res R 6	Nonres R 3	Res R 5	R 7	R 6	R 5
Below 40	0.20-0.26	50	Inches	1.0		1.5		1.5	1.5	1.5
			R-value	R 8.5		R 14		R 12	R 10	R 9

Footnote to Table 120.3-A:

1. These thickness are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.

Space-conditioning equipment

§150.0(j)1B – cont.

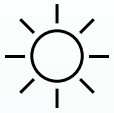
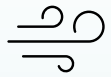
Insulation for piping and tanks

- Exceptions
  - Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.
  - Piping that penetrates framing members is not required to have insulation at the framing penetration.
  - Piping installed in interior or exterior walls, if all requirements are met for compliance with Quality Insulation Installation (QII) as specified in the Reference Residential Appendix RA3.5.
  - Piping surrounded with a minimum of 1 inch of wall insulation, 2 inches of crawlspace insulation, or 4 inches of attic insulation.

Space-conditioning equipment

§150.0(j)2

Insulation protection

- Pipe insulation must meet the insulation protection requirements of Section 120.3(b).
- Protection from damages due to:
  - Sunlight 
  - Wind 
  - Moisture 
  - Maintenance equipment 

Requirements for Ducts and Plenums

§150.0(m)1

CMC compliance

- All air distribution systems must be installed, sealed and insulated to meet the requirements of the California Mechanical Code (CMC) and ANSI/SMACNA-006-2006 HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition
- This includes the following:
  - Ducts
  - Plenums
  - Mechanical closets
  - Air-handler boxes

Requirements for Ducts and Plenums

§150.0(m)1 - cont.

CMC compliance

- Portions of supply-air and return-air ducts and plenums
  - Insulation R-6 or higher, or
  - Insulation not required if located entirely in conditioned space
    - Confirmed through field verification and diagnostic testing per RA3.1.4.3.8

Requirements for Ducts and Plenums

§150.0(m)1 - cont.

CMC compliance

- Connections of metal ducts and the inner core of flexible ducts must be mechanically fastened.
- Openings must be sealed with mastic, tape, aerosol sealant, that meets the requirements of UL 723 or other duct-closure system that meets the requirements of UL 181, 181A, or 181B.
- If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape must be used.

Requirements for Ducts and Plenums

§150.0(m)1 – cont.

Insulation Exceptions

- Portions of the duct system located in conditioned space if:
  - Noninsulated portion is located entirely inside the thermal envelope; and
  - All transitions into unconditioned space are air-sealed and insulated to R-6.
- Ducts and fans integral to a wood heater or fireplace.

Requirements for Ducts and Plenums

§150.0(m)9

Protection of insulation

- Insulation must be protected from damages due to:
  - Sunlight
  - Wind
  - Moisture
  - Maintenance equipment
- Exposed insulation protection
  - Aluminum, sheet metal, painted canvas, plastic cover
  - Cellular foam can be protected by coating that is water retardant and provides shielding from solar radiation.

Requirements for Ducts and Plenums

§150.0(m)11

Duct system sealing and leakage testing

Space conditioning systems with forced air duct systems that supply conditioned air to an occupiable space must be:

- Confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix RA3.1
- Conform to §150.0(m)11A or B

Requirements for Ducts and Plenums

§150.0(m)11A

Duct system sealing and leakage testing

Single-family dwellings & townhouses with air-handling unit (AHU) and the ducts connected directly to the air handler must have

- Total leakage ≤ 5% of air handler airflow determined per procedures mentioned in Reference Residential Appendix RA3.1.4.3.1.

Requirements for Ducts and Plenums

§150.0(m)11B

Duct system sealing and leakage testing

Single family dwellings & townhouses at rough-in stage of construction (prior to install of dwelling's interior finishing)

- AHU installed
  - Total Leakage ≤ 5% of air handler airflow determined per RA3.1.4.3.2, RA3.1.4.3.2.1 and RA3.1.4.3.3.
- AHU not installed
  - Total Leakage ≤ 4% of air handler airflow determined per RA3.1.4.3.2, RA3.1.4.3.2.2 and RA3.1.4.3.3.

Requirements for Ducts and Plenums

§150.0(m)12

Air Filtration

- MERV 13 filter efficiency required.
- HRV and ERV systems require filters.
- Space conditioning system air filters must be labeled with efficiency, and pressure drop rating.
- Air filter racks or grilles be gasketed or sealed to prevent air from bypassing filter.

Requirements for Ducts and Plenums

§150.0(m)12

Air Filtration

- Air filter racks or grilles be gasketed or sealed

Requirements for Ducts and Plenums

§150.0(m)12A

System types

Air filters required:

- Mechanical space-conditioning systems with ductwork exceeding 10 feet (3 m) in length.
- Mechanical supply-only ventilation systems and makeup air systems that provide outside air to an occupiable space.
- The supply side of mechanical balanced ventilation systems, including HRV systems, and ERV systems that provide outside air to an occupiable space.

Exception: Evaporative coolers

Requirements for Ducts and Plenums

§150.0(m)12B

System design and installation

System designed to ensure all recirculated air and all outdoor air supplied must be filtered.

- Exception: For HRV and ERV the location of the filters may be downstream, provided the system is equipped with ancillary filtration upstream of the system's thermal conditioning component

Systems must have air filters and meet the following:

- 2-inch minimum depth filter determined by the system designer, OR
- 1-inch minimum depth filter sized per equation 150.0-A at ≤ 150 ft/min face velocity

$$A_{face} = Q_{filter} / V_{face} \quad \text{Equation 150.0-A}$$

A_{face} = air filter face area (ft^2)
Q_{filter} = design air flow rate (ft^3/min)
V_{face}= air filter face velocity (150 ft/min or less)

Requirements for Ducts and Plenums

§150.0(m)12B

System design and installation – cont.

- Air filters must be accessible for regular service by system owner.
- Air filter locations must be labeled with applicable design airflow rate and the maximum allowable clean-filter pressure drop.
- Filter racks or grilles shall use gaskets, sealing or other means to close gaps around inserted filters to and prevent air from bypassing the filter.

Requirements for Ducts and Plenums

§§150.0(m)12C,D,E

Air filter efficiency

- Efficiency equal to or greater than MERV 13.

Air filter pressure drop

- The maximum allowable clean-filter pressure drop for the nominal two-inch minimum depth filter must be determined by system designer, or
- 25 PA (0.1-inch water) is the maximum pressure drop for nominal one-inch depth filter

Air filter product labeling

- Systems must be labeled by the manufacturer with air filter efficiency and pressure drop ratings.

Requirements for Ducts and Plenums

§150.0(m)13

Airflow rate and fan efficacy

- Fan efficacy for systems supplying cooling with ducts
  - All single and multi-zone systems:
    - Airflow rate ≥ 350 cfm per ton of nominal cooling system
    - Systems with gas furnaces fan efficacy ≤ 0.45 W/cfm
    - All other air handlers must be ≤ 0.58 W/cfm
  - Small Duct High Velocity Systems requirements:
    - Airflow rate ≥ 250 cfm per ton of cooling
    - Fan efficacy ≤ 0.62 W/cfm
  - HERS verification required

Requirements for Ducts and Plenums

§150.0(m)13

Airflow rate and fan efficacy

- Alternative to airflow rate and fan efficacy
  - Returns can be sized per Table 150.0-B or Table 150.0-C

Requirements for Ducts and Plenums

§150.0(m)13

Airflow rate and fan efficacy

Table 150.0-B

TABLE 150.0-B: Return Duct Sizing for Single Return Duct Systems

Return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees, one bend shall be a metal elbow.

Return grille devices shall be labeled in accordance with the requirements in Section 150.0(m)12Biv to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of 25 Pa (0.1 inches water) for the air filter when tested using ASHRAE Standard 52.2, or as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.

SYSTEM NOMINAL COOLING CAPACITY **(Ton)***	**RETURN DUCT MINIMUM NOMINAL DIAMETER** **(inch)**	**MINIMUM TOTAL RETURN FILTER GRILLE NOMINAL AREA** (inch^2)
1.5	16	500
2.0	18	600
2.5	20	800

*Not applicable to systems with nominal cooling capacity greater than 2.5 tons or less than 1.5 ton.

Requirements for Ducts and Plenums

§150.0(m)13

Airflow rate and fan efficacy

Table 150.0-C

TABLE 150.0-C: Return Duct Sizing for Multiple Return Duct Systems

Each return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees,°, one bend shall be a metal elbow.

Return grille devices shall be labeled in accordance with the requirements in Section 150.0(m)12Biv to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of 25 Pa (0.1 inches water) for the air filter when tested using ASHRAE Standard 52.2, or as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.

System Nominal Cooling Capacity (Ton)*	Return Duct 1 Minimum Nominal Diameter (inch)	Return Duct 2 Minimum Nominal Diameter (inch)	Minimum Total Return Filter Grille Nominal Area (inch²)
1.5	12	10	500
2.0	14	12	600
2.5	14	14	800
3.0	16	14	900
3.5	16	16	1000
4.0	18	18	1200
5.0	20	20	1500

*Not applicable to systems with nominal cooling capacity greater than 5.0 tons or less than 1.5 tons.

Ventilation and Indoor Air Quality

§150.0(o)1A

The requirements of ASHRAE 62.2-2019 apply except as amended by this section.

Amendments to ASHRAE 62.2

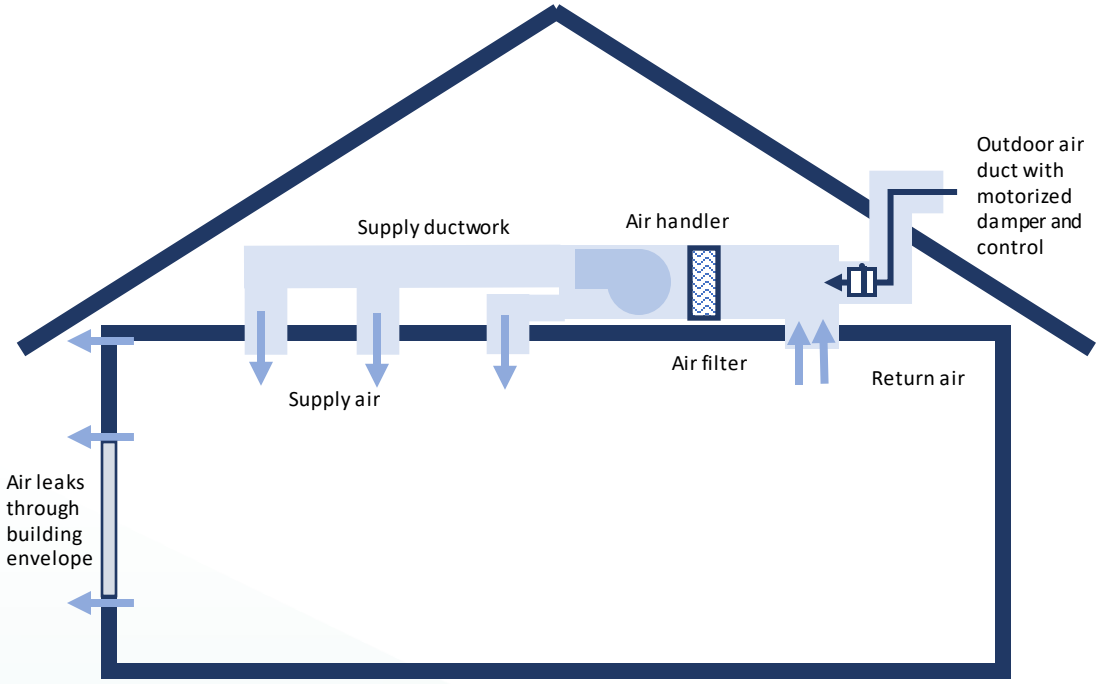
- Window Operation
  - Window operation is not a permissible method of providing the dwelling unit ventilation.

Ventilation and Indoor Air Quality

§150.0(o)1B

Amendments to ASHRAE 62.2 – cont.

- Central Fan Integrated (CFI) Ventilation Systems
  - Continuous operation of central system air handlers is not allowed for providing the dwelling unit ventilation airflow.
  - Motorized outdoor air damper must be installed and controlled.
  - Variable ventilation controls
    - Systems must have controls to track outdoor air ventilation run time.
    - Systems must operate space-conditioning system central fan and outdoor air damper when necessary.



Ventilation and Indoor Air Quality

§150.0(o)1Ci

Amendments to ASHRAE 62.2 – cont.

- Whole-dwelling unit mechanical ventilation for single-family detached and townhouses
  - Total required dwelling unit ventilation rate [ASHRAE 62.2:4.1.1]

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

Where:

Q_{tot} = total required ventilation rate, cfm

A_{floor} = dwelling-unit floor area, ft^2

N_{br} = number of bedrooms (not to be less than 1)

Ventilation and Indoor Air Quality

§150.0(o)1Ciia

Amendments to ASHRAE 62.2 – cont.

- Whole-dwelling unit mechanical ventilation for single-family detached and townhouses
  - Effective Annual Average Infiltration Rate

  Need to determine Q_{50} using Option 1 or 2.
    - Option 1 - Determine the dwelling unit leakage at 50 Pa, Q_{50} by assuming ACH_{50}

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

      Where:
      Q_{50} = assumed leakage rate at 50 Pa, cfm
      V_{du} = dwelling unit conditioned volume, ft^3
      ACH_{50} = assumed air changes per hour at 50 Pa (0.2 inches water)

Ventilation and Indoor Air Quality

§150.0(o)1Ciia

Amendments to ASHRAE 62.2 – cont.

- Whole-dwelling unit mechanical ventilation for single-family detached and townhouses
  - Effective Annual Average Infiltration Rate
    - Option 2 - Determine the dwelling unit leakage at 50 Pa, Q_{50} using verified ACH_{50} by field verification and diagnostic testing

$Q_{50} = V_{du}$ x verified ACH_{50} / 60 min Equation 150.0-D

Where:
Q_{50} = leakage rate at 50 Pa, cfm
V_{du} = dwelling unit conditioned volume, ft^3
ACH_{50} = air changes per hour at 50 Pa (0.2 inches water), HERS verified

Ventilation and Indoor Air Quality

§150.0(o)1Ciib

Amendments to ASHRAE 62.2 – cont.

- Whole-dwelling unit mechanical ventilation for single-family detached and townhouses
  - Effective Annual Average Infiltration Rate [ASHRAE 62.2:4.1.2.1]
    - Use Q_{50} from equation 150.0-C or D

$$Q_{\text{inf}} = 0.052 \times Q_{50} \times wsf \; x \; [H/H_r]^z$$ Equation 150.0-E

Where:
Q_{inf} = effective annual infiltration rate, cfm (L/s)
Q_{50} = Leakage rate at 50 Pa from equation 150.0-C or equation 150.0-D
wsf = weather and shielding factor from Table 150.0-D
H = vertical distance between the lowest and highest above-grade points within the pressure boundary, ft (m)
H_r = reference height, 8.2 ft (2.5 m)
z = 0.4 for the purpose of calculating the Effective Annual Average Infiltration Rate

Ventilation and Indoor Air Quality

§150.0(o)1Ciii

Amendments to ASHRAE 62.2 – cont.

- Whole-dwelling unit mechanical ventilation for single-family detached and townhouses
  - Required Mechanical Ventilation Rate [ASHRAE 62.2:4.1.2]

$$Q_{\text{fan}} = Q_{\text{tot}} - F\,(Q_{inf} \times A_{ext})$$ Equation 150.0-F

Where:

Q_{fan} = required mechanical ventilation rate, cfm (L/s)

Q_{tot} = total required ventilation rate, cfm (L/s) from Equation 150.0-B

Q_{inf} = effective annual average infiltration rate, cfm (L/s) from equation 150.0-E

F = 1 for balanced ventilation systems and Qinf/Qtot otherwise

A_{ext} = 1 for single-family detached homes, or the ratio of exterior envelope surface area that is not attached to garages or other dwelling units to total envelope surface area for attached dwelling units not sharing ceilings or floors with other dwelling units, occupiable spaces, public garages, or commercial spaces.

Ventilation and Indoor Air Quality

§§150.0(o)1Gi,ii

Amendments to ASHRAE 62.2 – cont.

- Local mechanical exhaust
  - Nonenclosed kitchens must have demand-controlled mechanical exhaust system.
  - Enclosed kitchens and all bathrooms must have either demand-controlled or continuous mechanical exhaust system.
    - Enclosed kitchen per ASHRAE 62.2: a kitchen whose permanent openings to interior adjacent spaces do not exceed a total of 60 ft² (6 m²).

Ventilation and Indoor Air Quality

§150.0(o)1Giii

Amendments to ASHRAE 62.2 – cont.

- Local mechanical exhaust
  - Demand-controlled mechanical exhaust
    - Control and operation: Occupant controlled ON-OFF control and automatic control that not impede occupant ON control.
    - Ventilation rate and capture efficiency: must meet or exceed either minimum airflow in Table 150.0-E or the minimum capture efficiency in Table 150.0-E and Table 150.0-G.

Ventilation and Indoor Air Quality

§150.0(o)1Giv

Amendments to ASHRAE 62.2 – cont.

- Local mechanical exhaust
  - Continuous mechanical exhaust
    - Control and operation: Manual ON-OFF control and accessible to the dwelling unit occupant.
    - Ventilation rate: Must meet minimum delivered ventilation in Table 150.0-F

Ventilation and Indoor Air Quality

Table 150.0-E,F

Table 150.0-E Demand-Controlled Local Ventilation Exhaust Airflow Rates and Capture Efficiency

Application	Compliance Criteria
Enclosed Kitchen or Nonenclosed Kitchen	Vented range hood, including appliance-range hood combinations shall meet either the capture efficiency (CE) or the airflow rate specified in Table 150.0-G as applicable.
Enclosed Kitchen	Other kitchen exhaust fans, including downdraft: 300 cfm (150 L/s) or a capacity of 5 ACH
Nonenclosed Kitchen	Other kitchen exhaust fans, including downdraft: 300 cfm (150 L/s)
Bathroom	50 cfm (25 L/s)

Table 150.0-F Continuous Local Ventilation Exhaust Airflow Rates

Application	Airflow
Enclosed kitchen	5 ach, based on kitchen volume
Bathroom	20 cfm (10 L/s)

Ventilation and Indoor Air Quality

Table 150.0-G

Table 150.0-G Kitchen Range Hood Airflow Rates (cfm) and ASTM E3087 Capture Efficiency (CE) Ratings According to Dwelling Unit Floor Area and Kitchen Range Fuel Type

Dwelling Unit Floor Area (ft²)	Hood Over Electric Range	Hood Over Natural Gas Range
>1500	50% CE or 110 cfm	70% CE or 180 cfm
>1000 - 1500	50% CE or 110 cfm	80% CE or 250 cfm
750 - 1000	55% CE or 130 cfm	85% CE or 280 cfm
<750	65% CE or 160 cfm	85% CE or 280 cfm

Ventilation and Indoor Air Quality

§150.0(o)1Gv,vi

Amendments to ASHRAE 62.2 – cont.

- Local mechanical exhaust
  - Airflow measurement by the system installer
    - Measure the airflow per Reference Residential Appendix RA3.7, or
    - Installed exhaust fan and duct system per Table 150.0-H and visually inspected.
  - Sound ratings
    - Sound rated per section 7.2 of ASHRAE 62.2 with minimum airflow rate 100 cfm.

Ventilation and Indoor Air Quality

Table 150.0-H

Table 150.0-H Prescriptive Ventilation System Duct Sizing [ASHRAE 62.2:Table 5-3]

Fan Airflow Rating, cfm at minimum static pressure[f] 0.25 in. water (L/s at minimum 62.5 Pa)	≤50 (25)	≤80 (40)	≤100 (50)	≤125 (60)	≤150 (70)	≤175 (85)	≤200 (95)	≤250 (120)	≤350 (165)	≤400 (190)	≤450 (210)	≤700 (330)	≤800 (380)
Minimum Duct Diameter, in. (mm) [a,b] For Rigid duct	4 [e] (100)	5 (125)	5 (125)	6 (150)	6 (150)	7 (180)	7 (180)	8 (205)	9 (230)	10 (255)	10 (255)	12 (305)	12 [d] (305)
Minimum Duct Diameter, in. (mm) [a,b] For Flex duct [c]	4 (100)	5 (125)	6 (150)	6 (150)	7 (150)	7 (180)	8 (205)	8 (205)	9 (230)	10 (255)	NP	NP	NP

Ventilation and Indoor Air Quality

§150.0(o)1J

Amendments to ASHRAE 62.2 – cont.

- Local mechanical exhaust
  - Label for whole-dwelling unit ventilation system on-off control
    - Manual switches operating whole house ventilation systems must be labeled with the following or equivalent:

    “This switch controls the indoor air quality ventilation for the home. Leave it on unless the outdoor air quality is very poor.”

Ventilation and Indoor Air Quality

§150.0(o)2

Field verification and diagnostic testing

- Whole-dwelling unit ventilation airflow performance
  - Verified and tested per RA3.7
- Kitchen local mechanical exhaust – vented range hoods
  - Field verified per RA3.7.4.3
  - Rated by HVI or AHAM
- HRV and ERV system fan efficacy
  - Fan efficacy ≤ 1.0 W/cfm
  - HERS verified per RA3.7.4.4

Heat Pump Space Heater

§150.0(t)

Heat pump space heater ready

- 240 volt circuit installed within 3 feet from the furnace and accessible.
  - Blank cover shall be identified as “240V ready”
- Branch circuit conductors rated at 30 amps minimum.
- Main electrical service panel must have reserved space for double pole circuit breaker for future heat pump space heater.
  - Marked as “For Future 240V use”

Subchapter – 8
Single-family residential buildings

Performance and Prescriptive § 150.1

Performance and Prescriptive Compliance Approaches

§150.1(a)

Basic Requirements

Single-family residential buildings must comply with:

- §110.0 through §110.10
- §150.0
- Either Performance or Prescriptive standards for the Climate Zone in which the building is located.
    - Exception: If a single contiguous subdivision or tract falls in more than one Climate Zone, all buildings in the subdivision or tract may be designed to meet the performance or prescriptive standards for the climate zones that contains 50 percent or more of the dwelling units.

Performance and Prescriptive Compliance Approaches

§§150.1(b)1,2

Performance standards

- Newly constructed buildings
  - EDR1: hourly source energy
  - EDR2: time dependent valuation (TDV)
    - Efficiency EDR2, PV + flexibility = total EDR2
- Additions and alterations to existing buildings
  - Energy budget for additions and alterations expressed in TDV energy.

Performance and Prescriptive Compliance Approaches

§150.1(b)3A

Performance standards

- Compliance demonstration requirements
  - Certificate of compliance and application for building permit
    - Building permit application include:
      - Documents required per §10-103(a)1,2 which demonstrate energy efficiency design rating and total EDR meets or exceeds the standard design EDR for applicable CZ.

Performance and Prescriptive Compliance Approaches

§150.1(b)3B

Performance standards

- Compliance demonstration requirements
  - Field Verification

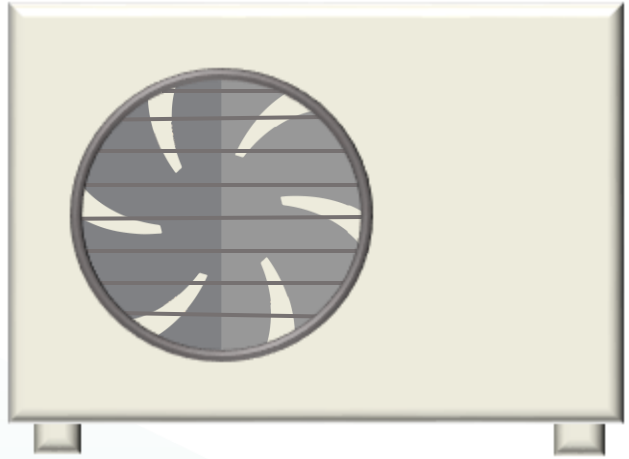
System	Tested per Reference Residential Appendix
EER/EER2/SEER/SEER2/CEER/HSPF/HSPF2 Rating (Systems with a rating that is greater than the minimum rating)	RA3.4
Variable capacity heat pump (VCHP)	RA3.4.4.3
Low leakage air handler	RA3.1.4.3.9
Heat pump – rated heating capacity (47° and 17°F)	RA3.4
Whole house fan	RA3.9
Central fan ventilation cooling system	RA3.3.4

Performance and Prescriptive Compliance Approaches

§150.1(c)6

Prescriptive standards/components packages

- Heating system type
  - Installed per Table 150.1-A
  - CZ 3,4,13 and 14 must be a heat pump for space conditioning system or meet performance compliance requirements.
- Exception:
  - Supplemental heating unit installed with unit thermal capacity < 2kW or 7,000 Btu/hr and controlled by time-limiting device not exceeding 30 min.



Performance and Prescriptive Compliance Approaches

Table 150.1-A

Table 150.1-A Prescriptive HVAC system

Climate Zone			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Space Heating [9]	Electric-Resistance Allowed		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
	If gas, AFUE		MIN	MIN	NA	NA	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	NA	NA	MIN	MIN
	If Heat Pump, HSPF [7] /HSPF2		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
Space Cooling	SEER/SEER2		MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
	Refrigerant Charge Verification or Fault Indicator Display		NR	REQ	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
	Whole-house fan[8]		NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	NR
Central System Air Handlers	Central Fan Integrated Ventilation System Fan Efficacy		REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
Ducts[10]	Roof/ Ceiling Option B	Duct Insulation	R-8	R-8	R- 6	R-8	R- 6	R- 6	R- 6	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8
		§150.1(c)9A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Roof/ Ceiling Option C	Duct Insulation	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R- 6	R-6	R-6	R- 6	R- 6	R- 6
		§150.1(c)9B	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ

Performance and Prescriptive Compliance Approaches

§150.1(c)7A

Prescriptive standards/components packages

- Space heating and space cooling
  - Refrigerant charge
    - Required in Climate Zones 2, and 8 – 15
    - Applies to ducted ACs and heat pumps (split or packaged), mini-splits, and small duct high velocity systems
    - Measurement access holes (MAH) per RA3.2.2.3
    - Refrigerant charge verified per RA 3.2
    - System airflow verification per RA 3.3
      - ≥ 350 cfm/ton for A/C and heat pump
      - ≥ 250 cfm/ton for small duct high velocity systems
    - HERS verified
    - Exceptions may apply

Performance and Prescriptive Compliance Approaches

§150.1(c)7A

Prescriptive standards/components packages

- Space heating and space cooling
  - Measurement Access Hole (MAH)

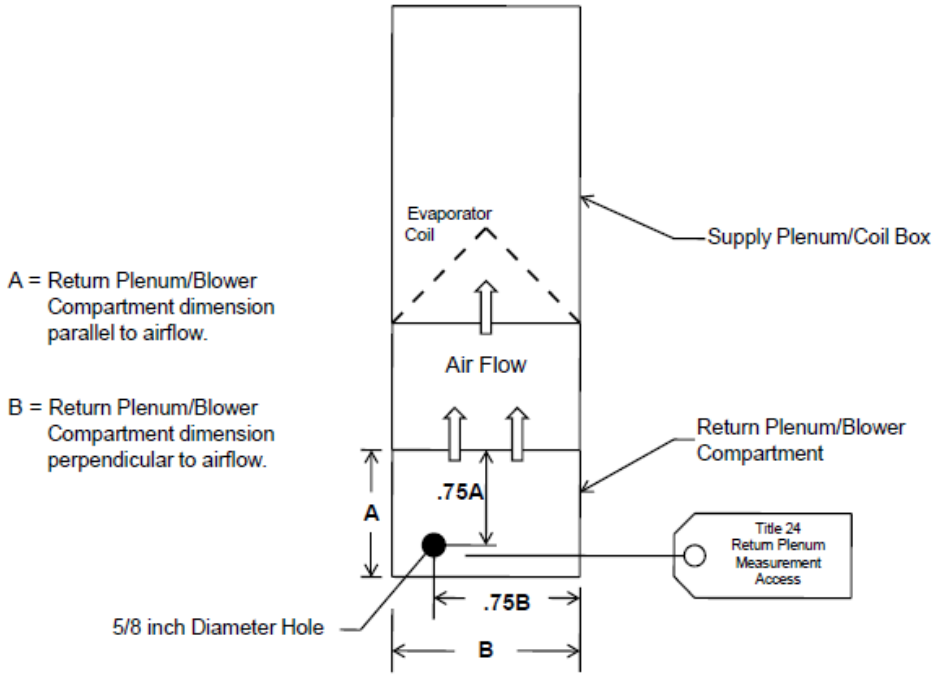


Figure RA3.2-1 Measurement Access Hole

Performance and Prescriptive Compliance Approaches

§150.1(c)9

Prescriptive standards/components packages

- Space conditioning distribution systems
  - Two options for duct insulation and location:
    - With a High Performance Attic (HPA) per §150.1(c)1Aii (Option B):
      - Ducts can be located in the HPA
      - Insulation levels per Table 150.1-A
    - With only ceiling insulation per §150.1(c)1Aiii (Option C):
      - Ducts and plenums must be inside conditioned space
      - Insulation levels per Table 150.1-A
      - Field verified by diagnostic testing per RA3.1.4.3.8
  - Table 150.1-A

Performance and Prescriptive Compliance Approaches

§150.1(c)10

Prescriptive standards/components packages

- Central Fan Integrated Ventilation Systems
  - Air-handling unit fan efficacy
    - Without Furnace: ≤ 0.58 W/cfm
    - With Furnace: ≤ 0.45 W/cfm
    - Small duct high velocity : ≤ 0.62 W/cfm
  - Continuous operation not allowed
  - Field Verification
    - Diagnostic Testing per RA3.3
    - Intermittent Ventilation Systems as specified in Reference Residential Appendix RA3.7.4.2

Performance and Prescriptive Compliance Approaches

§150.1(c)12

Prescriptive standards/components packages

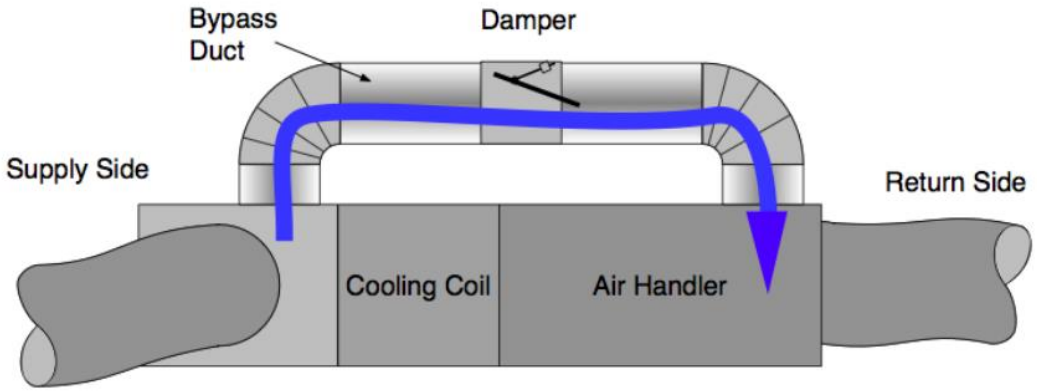
- Ventilation Cooling
  - Whole House Fan (WHF)
    - Required in Climate Zones 8 – 14 (Table 150.1-A)
  - WHF must meet the following:
    - Total air flow ≥ 1.5 cfm/ft² of conditioned floor area
    - Airflow rate must be listed in Home Ventilating Institute (HVI) Certified Products Directory
  - If not vented directly to the outside, attic vent free area must be the larger of:
    - At least ≥ 1 ft² for every 750 cfm of rated WHF Air Flow cfm; or
    - Manufacturers recommended free vent area
  - Provide 1 page “How to operate your whole house fan” sheet
- Exception
  - New dwelling units with a conditioned floor area of 500 square feet or less

Performance and Prescriptive Compliance Approaches

§150.1(c)13

Prescriptive standards/components packages

- HVAC system bypass ducts
  - Not allowed prescriptively.
  - More information
    - Blueprint Issue 110 (July – August 2015)



Subchapter – 9
Single-family residential buildings

Additions and Alterations § 150.2

Additions and Alterations to existing single-family residential buildings

§150.2(a)

Additions

- Additions to existing single-family building
  - New HVAC equipment installed to serve addition must meet applicable sections of:
    - §110.0 – 110.9 (Mandatory for all buildings)
    - §150.0(a) - (n), (p), (q) (Mandatory for single-family residential buildings)
    - §150.2(a)1 (Prescriptive approach) or §150.2(a)2 (Performance approach)

Additions and Alterations to existing single-family residential buildings

§150.2(a)

Additions

- Exceptions
  - No insulation per Section 150.0(j)1 for existing inaccessible piping.
  - Space conditioning system
    - No need for existing heating and cooling equipment to comply with Part 6 when heating and cooling extended from existing system but must meet CBC requirements.
  - Existing duct system and ducts must meet §150.2(b)1Di,ii when any length of ducts extended from existing duct system as addition.
  - No ventilation cooling requirements of §150.2(c)12 for additions 1,000 square feet or less.
  - Space heating system
    - New or replacement space heating system serving additions may be a heat pump or gas.

Additions and Alterations to existing single-family residential buildings

§150.2(a)1C

Additions

- Prescriptive Approach
  - Mechanical Ventilation for indoor Air quality
    - Whole-Dwelling Unit Mechanical Ventilation
      - No requirements for additions 1,000 ft² or less
      - No requirements for Junior ADUs that are additions to an existing building

      Note: New ADUs must comply with IAQ regardless of size
    - Local Mechanical Exhaust
      - Additions to existing buildings shall comply with all applicable requirements specified in 150.0(o)1G and 150.0(o)2.

Additions and Alterations to existing single-family residential buildings

§150.2(b)1

Alterations

- Prescriptive Approach
  - Altered components and new installed equipment that serves the alteration must meet applicable requirements within:
    - §110.0 – 110.9
    - §150.0
    - §150.2(b)1C – G (as applicable)

Additions and Alterations to existing single-family residential buildings

§150.2(b)1C

Alterations

- Prescriptive Approach
  - Entirely new or complete replacement space-conditioning systems must meet:
    - §150.0(h) – Space conditioning equipment
    - §150.0(i) - Thermostat
    - §150.0(j) – Insulation for piping and tanks
    - §150.0(m)1-10,12,13 – Air distribution and ventilation system ducts, plenums and fans
    - §150.1(c)7 – Space heating and space cooling
    - §150.2(b)1G – Altered Space Heating System
    - Table 150.2-A – Duct insulation R-Vaue
  - Systems include but not limited to condensing unit cooling or heating coil, and air handler for split systems; or complete replacement of a packaged unit; plus entirely new or replacement duct system.

Additions and Alterations to existing single-family residential buildings

§150.2(b)1Di

Alterations

- Prescriptive Approach
  - Altered duct systems - duct sealing
  - New or Replaced ducts > 25 ft
    - Duct Insulation
      - Min. R-6 confirmed by visual inspection for Unconditioned
      - No insulation for ducts completely inside directly conditioned space
    - Prescriptive minimums for alterations in unconditioned space:
      - R-6 in Climate Zones 3,5 through 7
      - R-8 for Climate Zones 1,2,4,8 through 16

Additions and Alterations to existing single-family residential buildings

§150.2(b)1Diia

Alterations

- Prescriptive Approach
  - Entirely new or complete replacement duct system
    - 75% or more of the ducts are replaced
      - Duct Leakage testing is required in All CZs
      - Leakage ≤ 5% of total air handler airflow
    - MERV 13 filtration
    - Fan watt draw testing on systems with ≥ 350 cfm/ton of nominal cooling
      - Fan efficacy: ≤ 0.58 W/cfm
      - With Furnace: ≤ 0.45 W/cfm

Additions and Alterations to existing single-family residential buildings

§150.2(b)1Diib

Alterations

- Prescriptive Approach
  - Extension of an existing duct system (> 25 feet)
    - Duct leakage allowance
      - Leakage ≤ 10% of total air handler airflow; or
      - Leakage ≤ 7% to outside
      - If leakage requirements not met, visual inspection and smoke test by certified HERS Rater required to verify all accessible leaks are sealed.
    - Exception
      - Existing duct systems constructed, insulated or sealed with asbestos.

Additions and Alterations to existing single-family residential buildings

§150.2(b)1Diic

Alterations

- Prescriptive Approach
  - Altered ducts and duct system components in garage spaces
    - Duct leakage allowance
      - Leakage ≤ 6% of total air handler airflow; or
      - All accessible leaks are sealed and verified by visual inspection and smoke test by certified HERS Rater.

Additions and Alterations to existing single-family residential buildings

§150.2(b)1E

Alterations

- Prescriptive Approach
  - Altered space conditioning system – duct sealing
  - Duct leakage testing applies when replacing the air handler, condensing unit of a split system air conditioner or heat pump, or cooling or heating coil.
    - Duct leakage testing is required in all climate zones
      - Leakage ≤ 10% of total air handler airflow per RA3.1.4.3.1; or
      - Leakage ≤ 7% to outside per RA3.1.4.3.4; or
      - All accessible leaks are sealed and verified by visual inspection and a smoke test by certified HERS Rater.
    - Note: entirely new or complete replacement ducts leakage to 5% or less

Additions and Alterations to existing single-family residential buildings

§150.2(b)1F

Alterations

- Prescriptive Approach
  - Altered space conditioning system – mechanical cooling
  - Requirements when installing or replacing a refrigerant-containing component:
    - Setback thermostat must be installed
    - Airflow and Refrigerant charge is required in CZs 2, and 8 – 15
      - Small duct high velocity systems with nominal cooling capacity ≥ 250 cfm per ton, HERS tested
      - All other systems with nominal cooling capacity ≥ 300 cfm per ton, HERS tested
      - Refrigerant charge must be HERS verified using standard charge procedures, weigh-in procedure, or have HERS verified fault indicator display (FID) device

Additions and Alterations to existing single-family residential buildings

§150.2(b)1G

Alterations

- Prescriptive Approach
  - Altered space heating system
    - No electric resistance as the primary heat source.
  - Exceptions
    - If existing equipment is electric resistance either
      - Non-ducted systems
      - Ducted systems only replacing heating
      - Climate zones 7 or 15

Additions and Alterations to existing single-family residential buildings

§150.2(b)1J

Alterations

- Prescriptive Approach
  - Ceiling: Attic ceiling alterations or entirely new ducts or complete replacement per § 150.2(b)1Diia
    - Climate zones 1-4, 6, 8-16 assembly U-factor 0.020 or R-49
      - Exception: climate zones 1, 3, 6 with existing R-19
    - Air seal all accessible areas of ceiling in climate zones 2, 4, 8-16
      - Exception: existing R-19
    - Recessed luminaires must be insulated in climate zones 1-4, 8-16
      - IC rated or fire-proof cover
      - Exception: climate zones 1-4, 8-10 with existing R-19
    - Attic ventilation comply per CBC requirements

Additions and Alterations to existing single-family residential buildings

§150.2(b)1J

Alterations

- Prescriptive Approach
  - Ceiling: Additional exceptions
    - R-38 existing insulation installed at ceiling
    - Alteration would disturb asbestos
    - 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 § 150.2(b)1J not triggered for other dwelling units

Additions and Alterations to existing single-family residential buildings

§150.2(b)1Mi

Alterations

- Prescriptive Approach
  - Mechanical Ventilation for indoor air quality
    - Alterations to Whole-dwelling unit airflow
      - Altered ventilation fan must meet §150.0(o)1C, 1E or 1F if required by previous building permit.
      - Replaced ventilation fan must be rated for airflow and sound with ASHRAE 62.2 Sections 7.1 and 7.2 and airflow required for compliance.
      - Air filtration device must meet §150.0(m)12 if required by previous building permit.
      - No requirements, if not required by previous building permit.

Additions and Alterations to existing single-family residential buildings

§150.2(b)1Mii

Alterations

- Prescriptive Approach
  - Mechanical Ventilation for indoor air quality
    - Alterations to Local mechanical exhaust
      - Altered bathroom local mechanical exhaust, must meet or exceed §150.0(o)1G .
      - Altered kitchen local mechanical exhaust, must meet §150.0(o)1G; or airflow required by previous building permit or 100cfm whichever is greater.

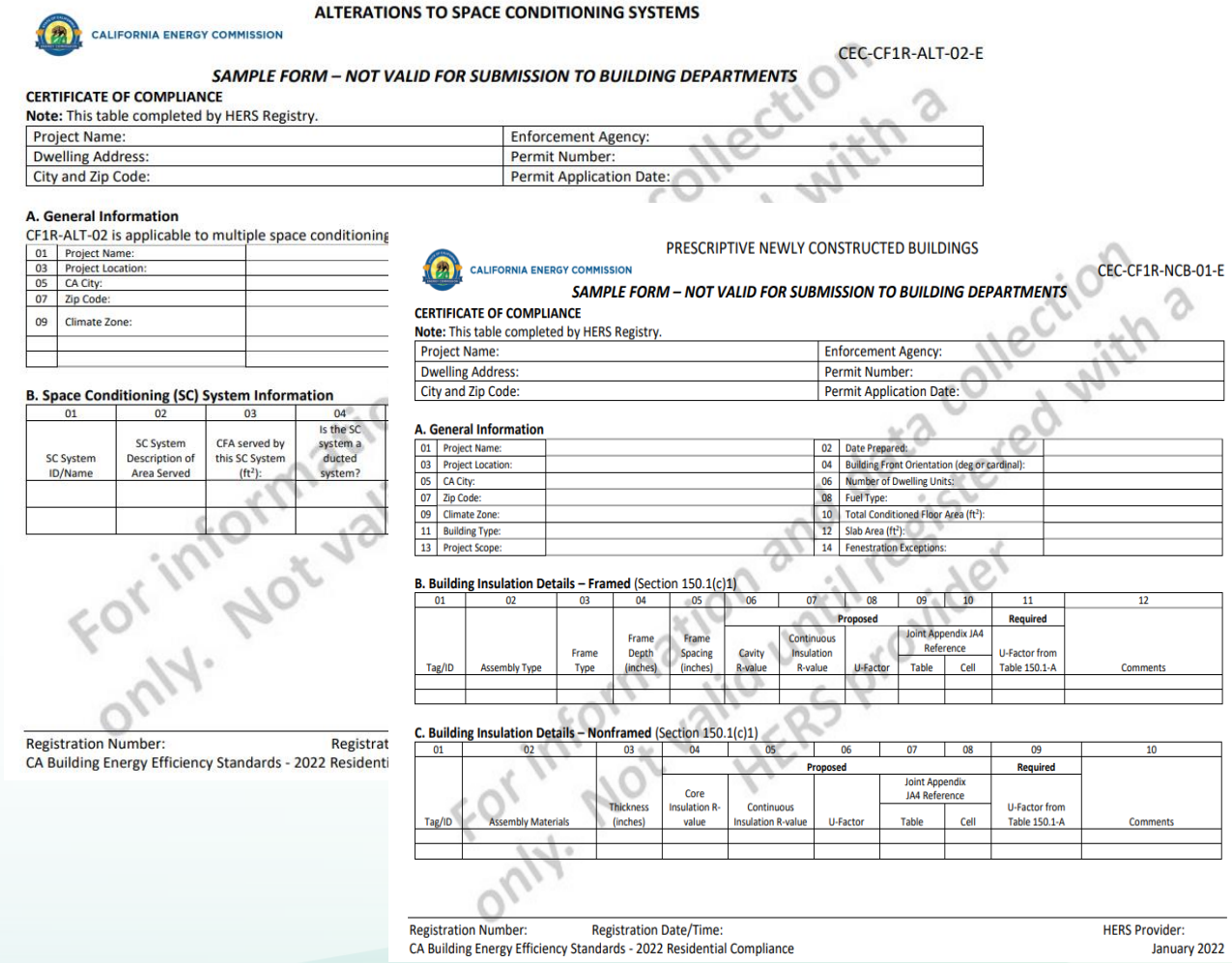
Single-family residential buildings

Enforcement: Compliance Forms

Enforcement – Prescriptive Compliance

Permit and Plans Review

- CF1R Residential Certificate of Compliance:
  - Verify required with or on plans at permit
  - Demonstrates compliance at design phase
  - Completed by designer, architect, energy consultant, engineer
  - Plans examiner verifies CF1R matches specs on plans
  - Form needs to be registered if HERS required.



ALTERATIONS TO SPACE CONDITIONING SYSTEMS

CALIFORNIA ENERGY COMMISSION

CEC-CF1R-ALT-02-E

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF COMPLIANCE

Note: This table completed by HERS Registry.

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

A. General Information

CF1R-ALT-02 is applicable to multiple space conditioning

01	Project Name:	
03	Project Location:	
05	CA City:	
07	Zip Code:	
09	Climate Zone:	

B. Space Conditioning (SC) System Information

01	02	03	04
SC System ID/Name	SC System Description of Area Served	CFA served by this SC System (ft²):	Is the SC system a ducted system?

Registration Number: Registrat

CA Building Energy Efficiency Standards - 2022 Residenti

PRESCRIPTIVE NEWLY CONSTRUCTED BUILDINGS

CALIFORNIA ENERGY COMMISSION

CEC-CF1R-NCB-01-E

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF COMPLIANCE

Note: This table completed by HERS Registry.

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

A. General Information

01	Project Name:		02	Date Prepared:	
03	Project Location:		04	Building Front Orientation (deg or cardinal):	
05	CA City:		06	Number of Dwelling Units:	
07	Zip Code:		08	Fuel Type:	
09	Climate Zone:		10	Total Conditioned Floor Area (ft²):	
11	Building Type:		12	Slab Area (ft²):	
13	Project Scope:		14	Fenestration Exceptions:	

B. Building Insulation Details – Framed (Section 150.1(c)1)

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

C. Building Insulation Details – Nonframed (Section 150.1(c)1)

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

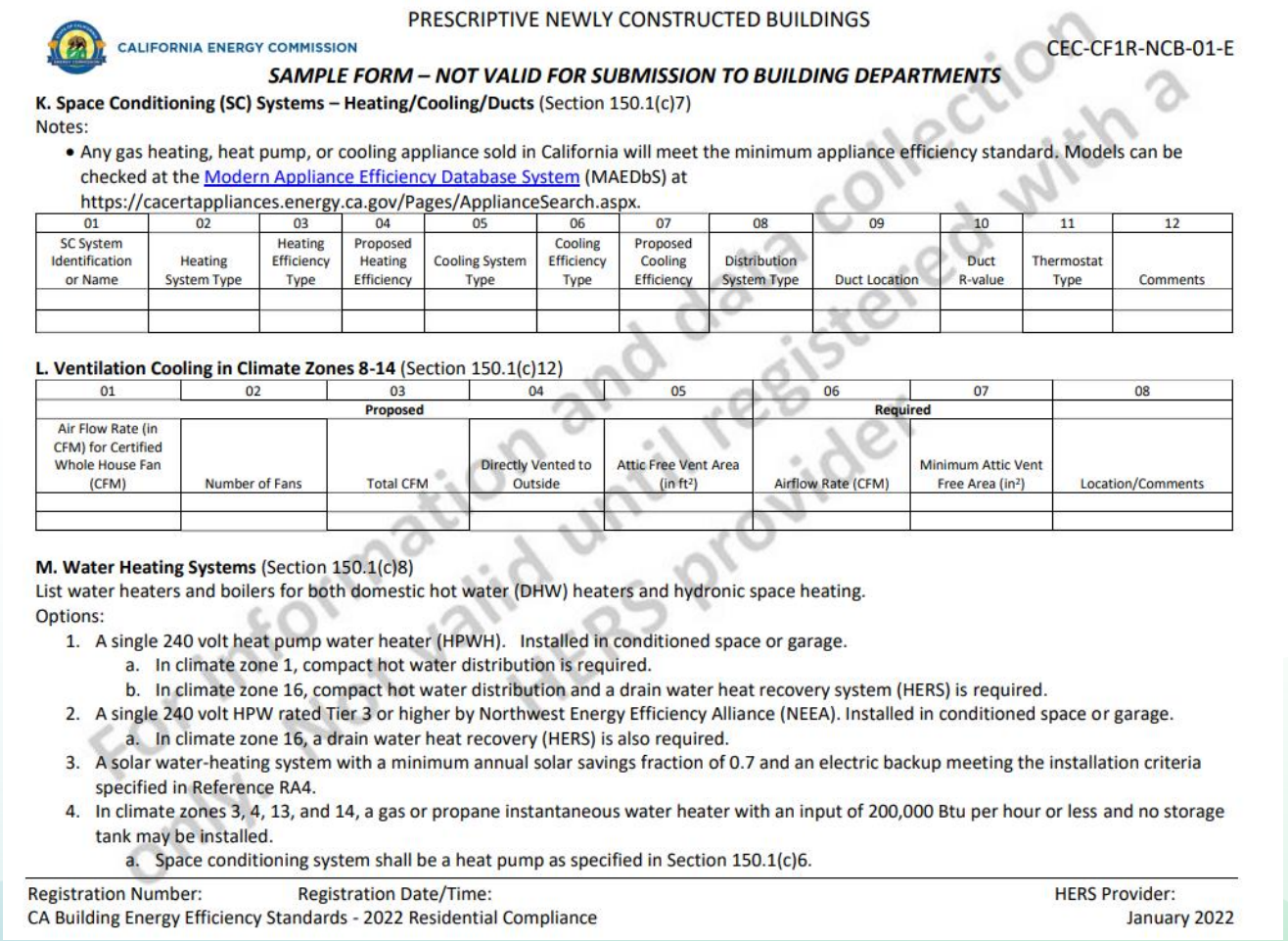
Registration Number: Registration Date/Time: HERS Provider:

CA Building Energy Efficiency Standards - 2022 Residential Compliance January 2022

Enforcement – Prescriptive Compliance

Permit and Plans Review

- CF1R Residential Certificate of Compliance



PRESCRIPTIVE NEWLY CONSTRUCTED BUILDINGS

CALIFORNIA ENERGY COMMISSION

CEC-CF1R-NCB-01-E

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

K. Space Conditioning (SC) Systems – Heating/Cooling/Ducts (Section 150.1(c)7)

Notes:

- Any gas heating, heat pump, or cooling appliance sold in California will meet the minimum appliance efficiency standard. Models can be checked at the Modern Appliance Efficiency Database System (MAEDbS) at https://cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx.

01	02	03	04	05	06	07	08	09	10	11	12
SC System Identification or Name	Heating System Type	Heating Efficiency Type	Proposed Heating Efficiency	Cooling System Type	Cooling Efficiency Type	Proposed Cooling Efficiency	Distribution System Type	Duct Location	Duct R-value	Thermostat Type	Comments

L. Ventilation Cooling in Climate Zones 8-14 (Section 150.1(c)12)

01	02	03	04	05	06	07	08
Proposed				Required			
Air Flow Rate (in CFM) for Certified Whole House Fan (CFM)	Number of Fans	Total CFM	Directly Vented to Outside	Attic Free Vent Area (in ft²)	Airflow Rate (CFM)	Minimum Attic Vent Free Area (in²)	Location/Comments

M. Water Heating Systems (Section 150.1(c)8)

List water heaters and boilers for both domestic hot water (DHW) heaters and hydronic space heating.

Options:

1. A single 240 volt heat pump water heater (HPWH). Installed in conditioned space or garage.
   a. In climate zone 1, compact hot water distribution is required.
   b. In climate zone 16, compact hot water distribution and a drain water heat recovery system (HERS) is required.
2. A single 240 volt HPW rated Tier 3 or higher by Northwest Energy Efficiency Alliance (NEEA). Installed in conditioned space or garage.
   a. In climate zone 16, a drain water heat recovery (HERS) is also required.
3. A solar water-heating system with a minimum annual solar savings fraction of 0.7 and an electric backup meeting the installation criteria specified in Reference RA4.
4. In climate zones 3, 4, 13, and 14, a gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank may be installed.
   a. Space conditioning system shall be a heat pump as specified in Section 150.1(c)6.

Registration Number: Registration Date/Time: HERS Provider:

CA Building Energy Efficiency Standards - 2022 Residential Compliance January 2022

Enforcement – Prescriptive Compliance

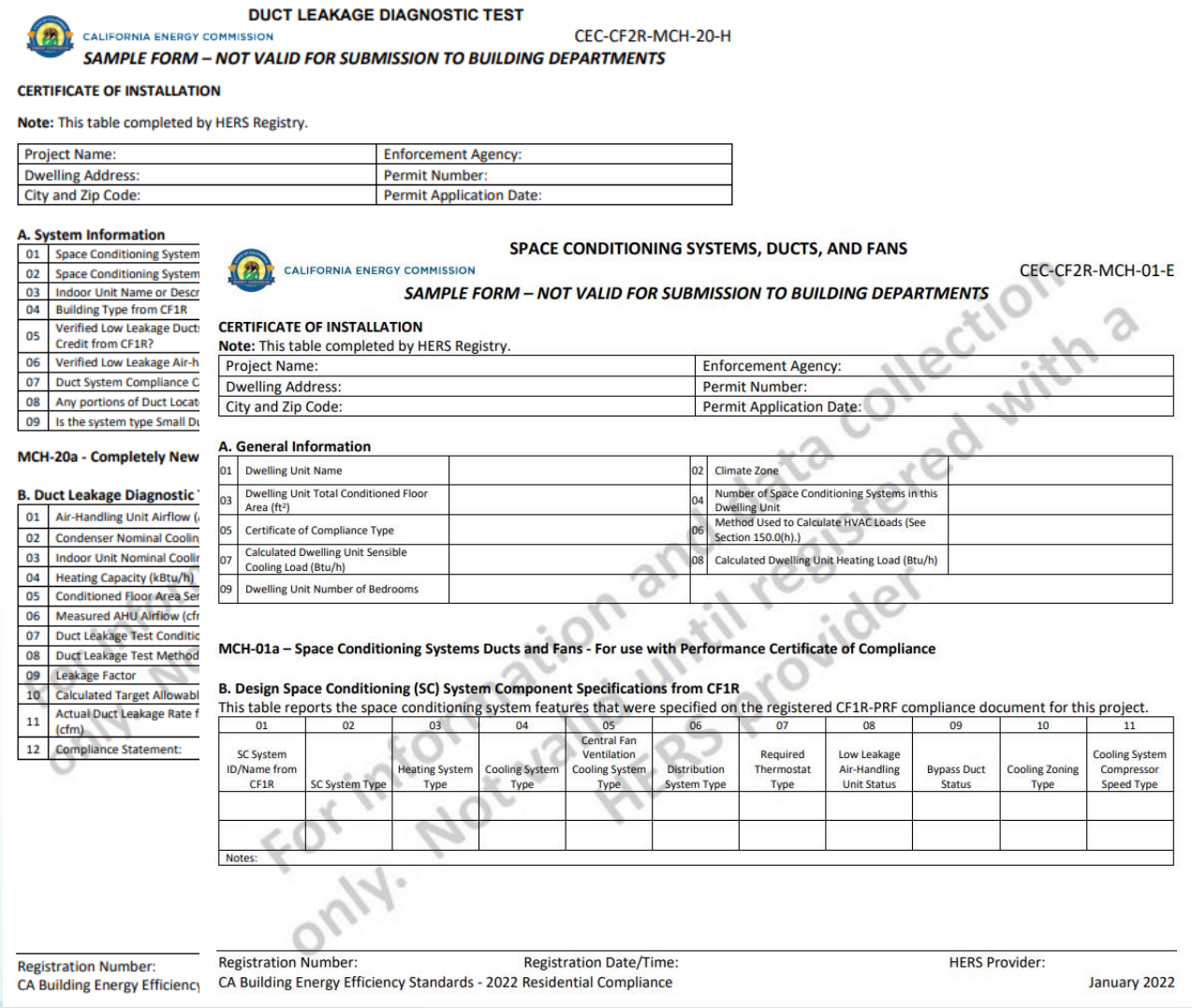
Permit and Plans Review

- CF1R Residential Certificate of Compliance
  - Different type of CF1R forms:
    - CF1R-ALT-02-E Alterations to Space Conditioning Systems
    - CF1R-NCB-01-E Newly Constructed Building
    - CF1R-ADD-02-E Residential Additions
    - CF1R-ALT-05-E Alterations

Enforcement – Prescriptive Compliance

Permit and Plans Review

- CF2R Residential Certificate of Installation:
  - Required for final inspection
  - Confirms compliance at installation
  - Completed by builder or installing contractor
  - Field inspector verifies efficiency and components match installed equipment and systems.
  - Form needs to be registered if HERS required.



DUCT LEAKAGE DIAGNOSTIC TEST

CALIFORNIA ENERGY COMMISSION CEC-CF2R-MCH-20-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF INSTALLATION

Note: This table completed by HERS Registry.

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

A. System Information

01	Space Conditioning System
02	Space Conditioning System
03	Indoor Unit Name or Descr
04	Building Type from CF1R
05	Verified Low Leakage Duct Credit from CF1R?
06	Verified Low Leakage Air-h
07	Duct System Compliance C
08	Any portions of Duct Locat
09	Is the system type Small Du

MCH-20a - Completely New

B. Duct Leakage Diagnostic

01	Air-Handling Unit Airflow (
02	Condenser Nominal Coolin
03	Indoor Unit Nominal Cooli
04	Heating Capacity (kBtu/h)
05	Conditioned Floor Area Ser
06	Measured AHU Airflow (cfr
07	Duct Leakage Test Conditic
08	Duct Leakage Test Method
09	Leakage Factor
10	Calculated Target Allowabl
11	Actual Duct Leakage Rate f (cfm)
12	Compliance Statement:

Registration Number:
CA Building Energy Efficiency

SPACE CONDITIONING SYSTEMS, DUCTS, AND FANS

CALIFORNIA ENERGY COMMISSION CEC-CF2R-MCH-01-E

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF INSTALLATION

Note: This table completed by HERS Registry.

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

A. General Information

01	Dwelling Unit Name		02	Climate Zone	
03	Dwelling Unit Total Conditioned Floor Area (ft²)		04	Number of Space Conditioning Systems in this Dwelling Unit	
05	Certificate of Compliance Type		06	Method Used to Calculate HVAC Loads (See Section 150.0(h).)	
07	Calculated Dwelling Unit Sensible Cooling Load (Btu/h)		08	Calculated Dwelling Unit Heating Load (Btu/h)	
09	Dwelling Unit Number of Bedrooms				

MCH-01a – Space Conditioning Systems Ducts and Fans - For use with Performance Certificate of Compliance

B. Design Space Conditioning (SC) System Component Specifications from CF1R

This table reports the space conditioning system features that were specified on the registered CF1R-PRF compliance document for this project.

01	02	03	04	05	06	07	08	09	10	11
SC System ID/Name from CF1R	SC System Type	Heating System Type	Cooling System Type	Central Fan Ventilation Cooling System Type	Distribution System Type	Required Thermostat Type	Low Leakage Air-Handling Unit Status	Bypass Duct Status	Cooling Zoning Type	Cooling System Compressor Speed Type

Notes:

Registration Number: Registration Date/Time: HERS Provider:
CA Building Energy Efficiency Standards - 2022 Residential Compliance January 2022

Enforcement – Prescriptive Compliance

Permit and Plans Review

- CF2R Residential Certificate of Compliance
  - Different type of CF2R forms:
    - CF2R-MCH-01-E Space Conditioning System New Construction
    - CF2R-MCH-02-E Whole House Fan
    - CF2R-MCH-04-E Evaporative Coolers
    - CF2R-MCH-20-H Duct Leakage Diagnostic Test - New Construction
    - CF2R-MCH-21-H QII - Air Infiltration Sealing - Framing Stage
    - CF2R-MCH-22-H Space Conditioning System Fan Efficacy
    - CF2R-MCH-23-H Space Conditioning System Airflow Rate
    - CF2R-MCH-24-H-Enclosure Air Leakage Worksheet

Enforcement – Prescriptive Compliance

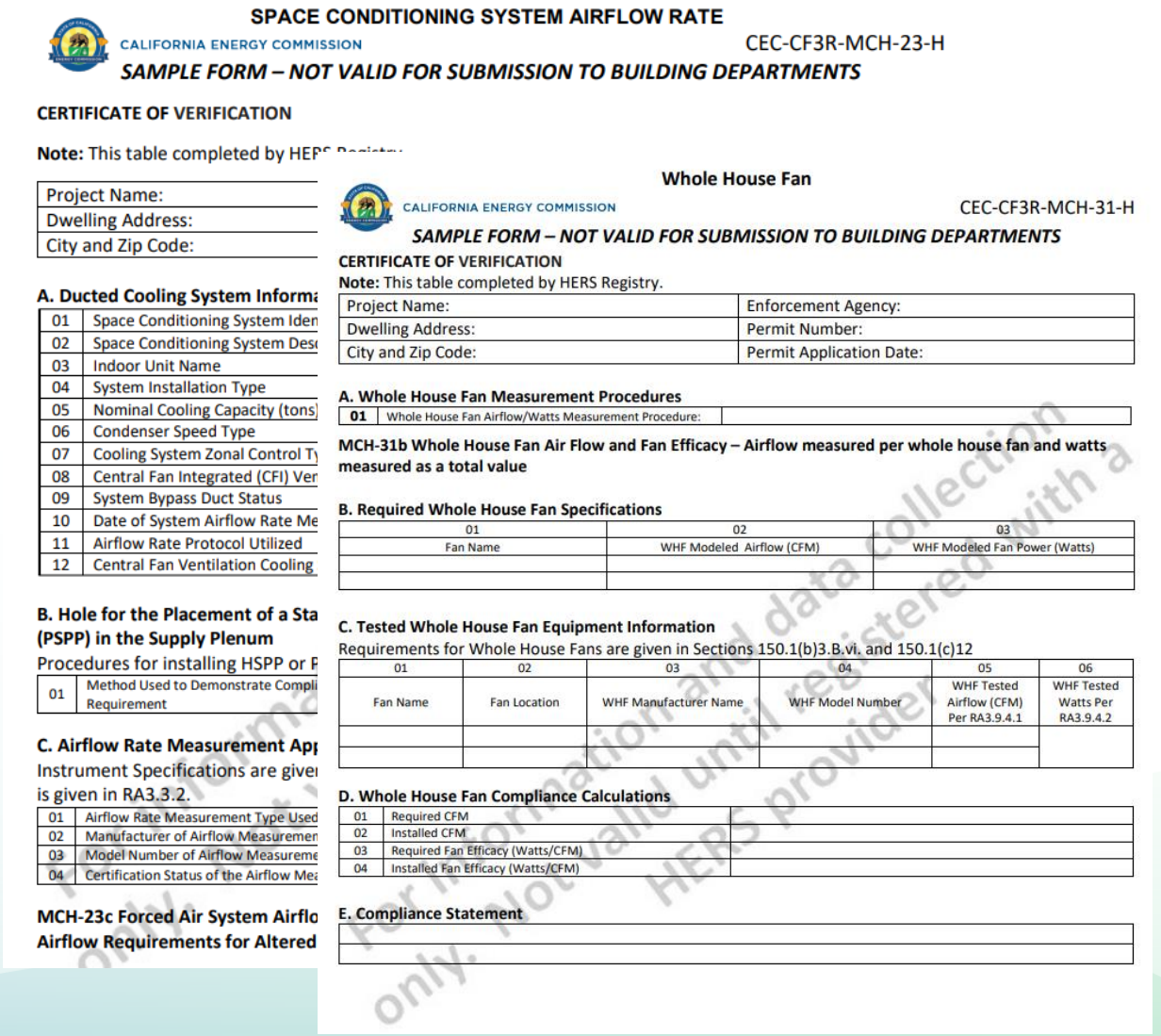
Permit and Plans Review

- CF2R Residential Certificate of Compliance
  - Different type of CF2R forms:
    - CF2R-MCH-25-H Refrigerant Charge Verification
    - CF2R-MCH-26-H Rated Space Conditioning System Equipment Verification
    - CF2R-MCH-27-H Indoor Air Quality and Mechanical Ventilation
    - CF2R-MCH-28-H Return Duct Design and Air Filter Device Sizing
    - CF2R-MCH-30-H Ventilation Cooling - Whole House Fan
    - CF2R-MCH-31-H Whole House Fan HERS
    - CF2R-MCH-32-H Local Mechanical Exhaust
    - CF2R-MCH-33-H Variable Capacity Heat Pump Compliance Credit
    - CF2R-MCH-34-E Pre-Cooling

Enforcement – Prescriptive Compliance

Permit and Plans Review

- CF3R Residential Certificate of Verification:
  - Required for final inspection
  - Confirms compliance with HERS testing requirements at installation (duct leakage, airflow, refrigerant charge, ventilation, compliance credits)
  - Completed by HERS rater, and forms must be registered with approved HERS provider.
  - Field inspector verifies testing and forms are complete, signed and registered when required.



SPACE CONDITIONING SYSTEM AIRFLOW RATE

CALIFORNIA ENERGY COMMISSION CEC-CF3R-MCH-23-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF VERIFICATION

Note: This table completed by HERS Registry

Project Name:	
Dwelling Address:	
City and Zip Code:	

A. Ducted Cooling System Informa

01	Space Conditioning System Iden
02	Space Conditioning System Des
03	Indoor Unit Name
04	System Installation Type
05	Nominal Cooling Capacity (tons)
06	Condenser Speed Type
07	Cooling System Zonal Control Ty
08	Central Fan Integrated (CFI) Ver
09	System Bypass Duct Status
10	Date of System Airflow Rate Me
11	Airflow Rate Protocol Utilized
12	Central Fan Ventilation Cooling

B. Hole for the Placement of a Sta (PSPP) in the Supply Plenum

Procedures for installing HSPP or P

01	Method Used to Demonstrate Compli Requirement

C. Airflow Rate Measurement Ap

Instrument Specifications are give is given in RA3.3.2.

01	Airflow Rate Measurement Type Used
02	Manufacturer of Airflow Measuremen
03	Model Number of Airflow Measureme
04	Certification Status of the Airflow Mea

MCH-23c Forced Air System Airflo Airflow Requirements for Altered

Whole House Fan

CALIFORNIA ENERGY COMMISSION CEC-CF3R-MCH-31-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. Whole House Fan Measurement Procedures

01	Whole House Fan Airflow/Watts Measurement Procedure:	

MCH-31b Whole House Fan Air Flow and Fan Efficacy – Airflow measured per whole house fan and watts measured as a total value

B. Required Whole House Fan Specifications

01	02	03
Fan Name	WHF Modeled Airflow (CFM)	WHF Modeled Fan Power (Watts)

C. Tested Whole House Fan Equipment Information

Requirements for Whole House Fans are given in Sections 150.1(b)3.B.vi. and 150.1(c)12

01	02	03	04	05	06
Fan Name	Fan Location	WHF Manufacturer Name	WHF Model Number	WHF Tested Airflow (CFM) Per RA3.9.4.1	WHF Tested Watts Per RA3.9.4.2

D. Whole House Fan Compliance Calculations

01	Required CFM	
02	Installed CFM	
03	Required Fan Efficacy (Watts/CFM)	
04	Installed Fan Efficacy (Watts/CFM)	

E. Compliance Statement

Enforcement – Prescriptive Compliance

Permit and Plans Review

- CF3R Residential Certificate of Compliance
  - Different type of CF3R forms:
    - CF3R-MCH-20 Duct Leakage Diagnostic Test - New Construction
    - CF3R-MCH-21 Duct Location
    - CF2R-MCH-22-H Space Conditioning System Fan Efficacy
    - CF3R-MCH-23-H Space Conditioning System Airflow Rate
    - CF3R-MCH-24 Building Air Leakage Diagnostic Test
    - CF3R-MCH-25-H Refrigerant Charge Verification
    - CF3R-MCH-26-H Rated Space Conditioning System Equipment Verification

Enforcement – Prescriptive Compliance

Permit and Plans Review

- CF3R Residential Certificate of Compliance
  - Different type of CF3R forms:
    - CF3R-MCH-27-H Indoor Air Quality and Mechanical Ventilation
    - CF3R-MCH-28-H Return Duct Design and Air Filter Device Sizing
    - CF3R-MCH-29-H Duct Surface Area Reduction; R-Value; Buried Ducts Compliance Credit
    - CF3R-MCH-30-H Ventilation Cooling - Whole House Fan
    - CF3R-MCH-31-H Whole House Fan HERS
    - CF3R-MCH-32-H Local Mechanical Exhaust
    - CF3R-MCH-33-H Variable Capacity Heat Pump Compliance Credit

Enforcement – Prescriptive Compliance

Permit and Plans Review

- PSR (Project Status Report)

PROJECT STATUS REPORT — CalCERTS, Inc.
Effective 09/23/2021 11:06 — (Page 1 of 3)

GENERAL INFORMATION

Energy Standards Code Year	2019
Project Name	Smith Residence SFR
Project Type	New Construction SFR
Address	1111 Unicorn Lane
City/State/Zip	CalCERTSville / CA / 00000
Enforcement Agency	City of CalCERTSville
Permit Number	Permit 888
OVERALL STATUS	NOT COMPLETE
HERS VERIFIABLE MEASURES	COMPLETE

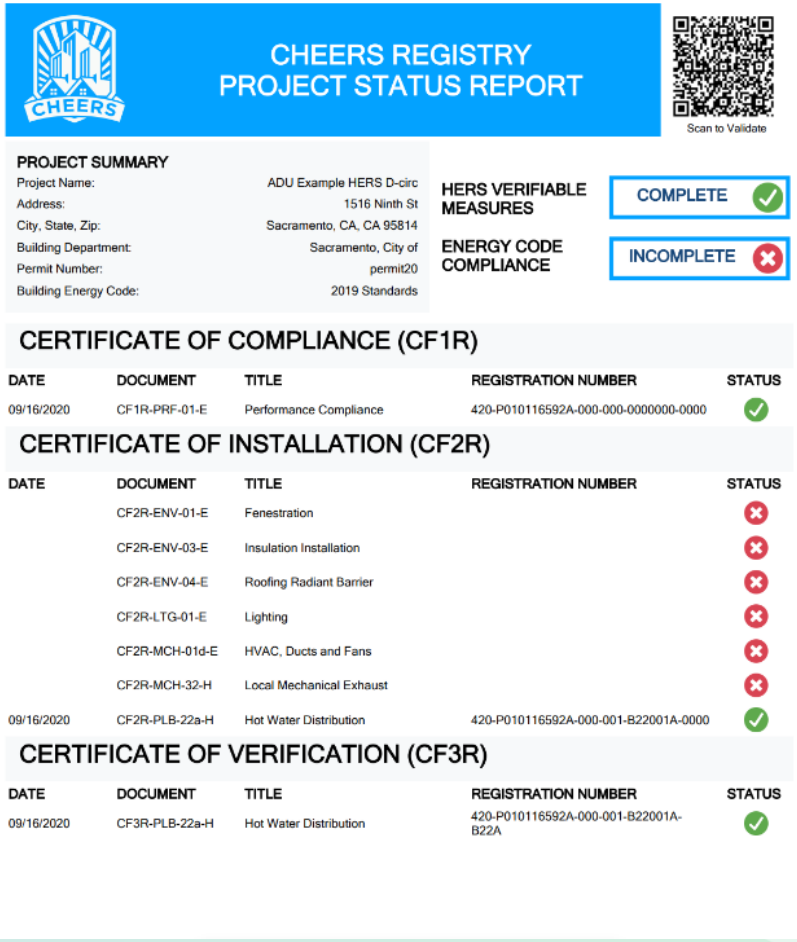
Easy to Verify @ calcerts.com

CF1R INFORMATION - Certificate of Compliance (Document Lists Required Energy Features)

Certificate Type	Compliance
Registered Form	CF1R-PRF-01
Registered Date	2021-09-23 10:40:39
Registration Number	221-P010199851A-000-000-0000000-0000

CF2R INFORMATION - Certificate of Installation (Documents the proper installation of required energy features)

System	Form	Registered Date	Registration Number	
	CF2R-ENV-01-E Fenestration Installation	2021-09-23 10:57:46	221-P010199851A-000-001-E01301A-0000 Johnny Installer (DEV INSTALLERS &)	✓
	CF2R-ENV-03-E Insulation Installation	2021-09-23 10:57:46	221-P010199851A-000-001-E03001A-0000 Johnny Installer (DEV INSTALLERS &)	✓
	CF2R-ENV-21-H QII-Framing Stage	2021-09-23 10:57:46	221-P010199851A-000-001-E21301A-0000 Johnny Installer (DEV INSTALLERS &)	✓
	CF2R-ENV-22-H QII-Insulation Installation	2021-09-23 10:57:46	221-P010199851A-000-001-E22001A-0000 Johnny Installer (DEV INSTALLERS &)	✓
	CF2R-LTG-01-E Lighting	2021-09-23 10:57:47	221-P010199851A-000-001-L01001A-0000 Johnny Installer (DEV INSTALLERS &)	✓



CHEERS REGISTRY
PROJECT STATUS REPORT

Scan to Validate

PROJECT SUMMARY

Project Name:	ADU Example HERS D-circ
Address:	1516 Ninth St
City, State, Zip:	Sacramento, CA, CA 95814
Building Department:	Sacramento, City of
Permit Number:	permit20
Building Energy Code:	2019 Standards

HERS VERIFIABLE MEASURES: COMPLETE
ENERGY CODE COMPLIANCE: INCOMPLETE

CERTIFICATE OF COMPLIANCE (CF1R)

DATE	DOCUMENT	TITLE	REGISTRATION NUMBER	STATUS
09/16/2020	CF1R-PRF-01-E	Performance Compliance	420-P010116592A-000-000-0000000-0000	✓

CERTIFICATE OF INSTALLATION (CF2R)

DATE	DOCUMENT	TITLE	REGISTRATION NUMBER	STATUS
	CF2R-ENV-01-E	Fenestration		✗
	CF2R-ENV-03-E	Insulation Installation		✗
	CF2R-ENV-04-E	Roofing Radiant Barrier		✗
	CF2R-LTG-01-E	Lighting		✗
	CF2R-MCH-01d-E	HVAC, Ducts and Fans		✗
	CF2R-MCH-32-H	Local Mechanical Exhaust		✗
09/16/2020	CF2R-PLB-22a-H	Hot Water Distribution	420-P010116592A-000-001-B22001A-0000	✓

CERTIFICATE OF VERIFICATION (CF3R)

DATE	DOCUMENT	TITLE	REGISTRATION NUMBER	STATUS
09/16/2020	CF3R-PLB-22a-H	Hot Water Distribution	420-P010116592A-000-001-B22001A-B22A	✓

Resources

Online Resource Center

www.energy.ca.gov/orc

Handouts

- Fact sheets
- Guides

Tools

- Checklists
- Blueprint newsletter

Training

- Presentations
- Videos

Links

- Internal resources
- External resources

2022 Energy Code Handouts

- Solar PV and battery fact sheets coming soon
- Covered processes fact sheets
- Envelope fact sheets
- Summary of significant changes
- Summary of mandatory requirements
- Download from the Online Resource Center

HERS Program

HERS Program information

CalCERTS, Inc. HERS PROVIDER	CHEERS
Newly constructed buildings	Newly constructed buildings
Additions	Additions
Alterations of residential and nonresidential buildings	Alterations of residential and nonresidential buildings
California whole-house home energy ratings	
HERS building performance contractors	

Blueprint Newsletter

Energy Code quarterly newsletter

- Updates
- Clarifications
- Frequently asked questions

Issue 138 | April - June 2022

BLUEPRINT

CALIFORNIA ENERGY COMMISSION

EFFICIENCY DIVISION

IN THIS ISSUE

- 2022 Energy Code: Multifamily Summary
- 2022 Energy Code: Compliance Software
- 2019 Energy Code: HERS Verifications
- Q&A
  - Solar PV for Multifamily Buildings
  - Multifamily Water Heating
  - Multifamily Common Use Areas

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

2022 Energy Code: Multifamily Summary

The 2022 Building Energy Efficiency Standards (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 in § 100.1, and moves all requirements for multifamily buildings to §§ 160.0-180.4. This and other significant changes include:

Mandatory Requirements

- Updates minimum efficiencies for HVAC equipment; adds minimum efficiency requirements for dedicated outdoor air systems (DOAS), heat pump, and heat recovery chiller packages. § 110.2
- Changes demand responsive lighting controls trigger to 4,000 watts or more; adds requirements for controlled receptacles. §§ 110.12, 160.5(b)4E
- Unifies envelope insulation, vapor retarder, and fenestration requirements. § 160.1
- For dwelling units
  - Adds requirements for central fan integrated ventilation systems requiring a motorized controlled damper, damper controls, and variable ventilation. § 160.2(b)2Aii
  - Requires vented kitchen range hoods ventilation rates or capture efficiencies based on conditioned floor area and fuel type per Tables 160.2-E, F, G. § 160.2(b)2Avic2
  - Requires a HERS-verified maximum fan efficacy of 1.0 Watts per cfm for heat recovery ventilation (HRV) and energy recovery ventilation (ERV) systems. § 160.2(b)2Biii
  - Adds mechanical acceptance testing requirements. § 160.3(d)2
  - Adds electric-ready requirements when gas equipment is installed for space heating, cooking, and clothes dryers. § 160.9(a-c)

1

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

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

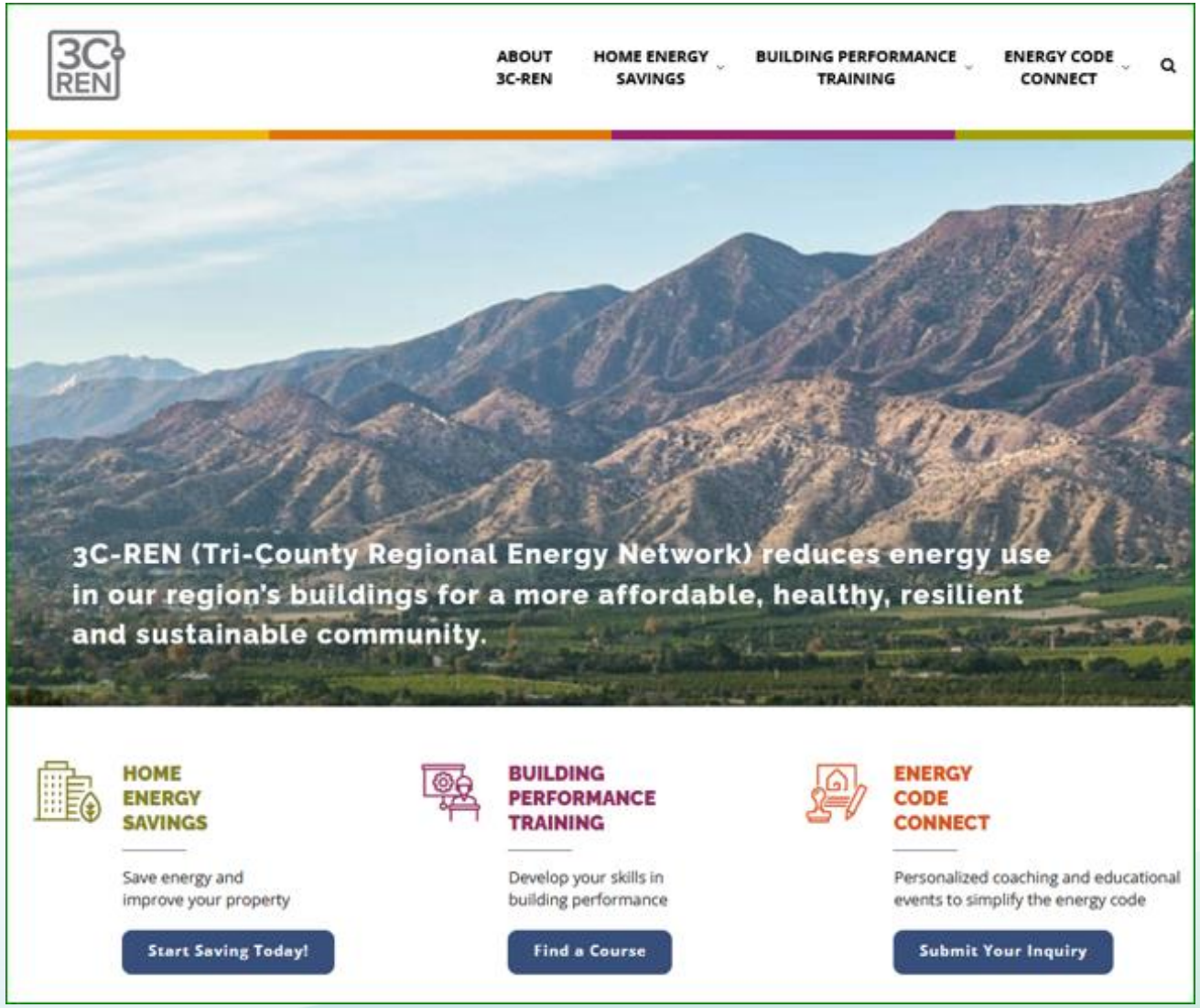
- 800-772-3300 in CA
- 916-654-5106 outside CA

Email

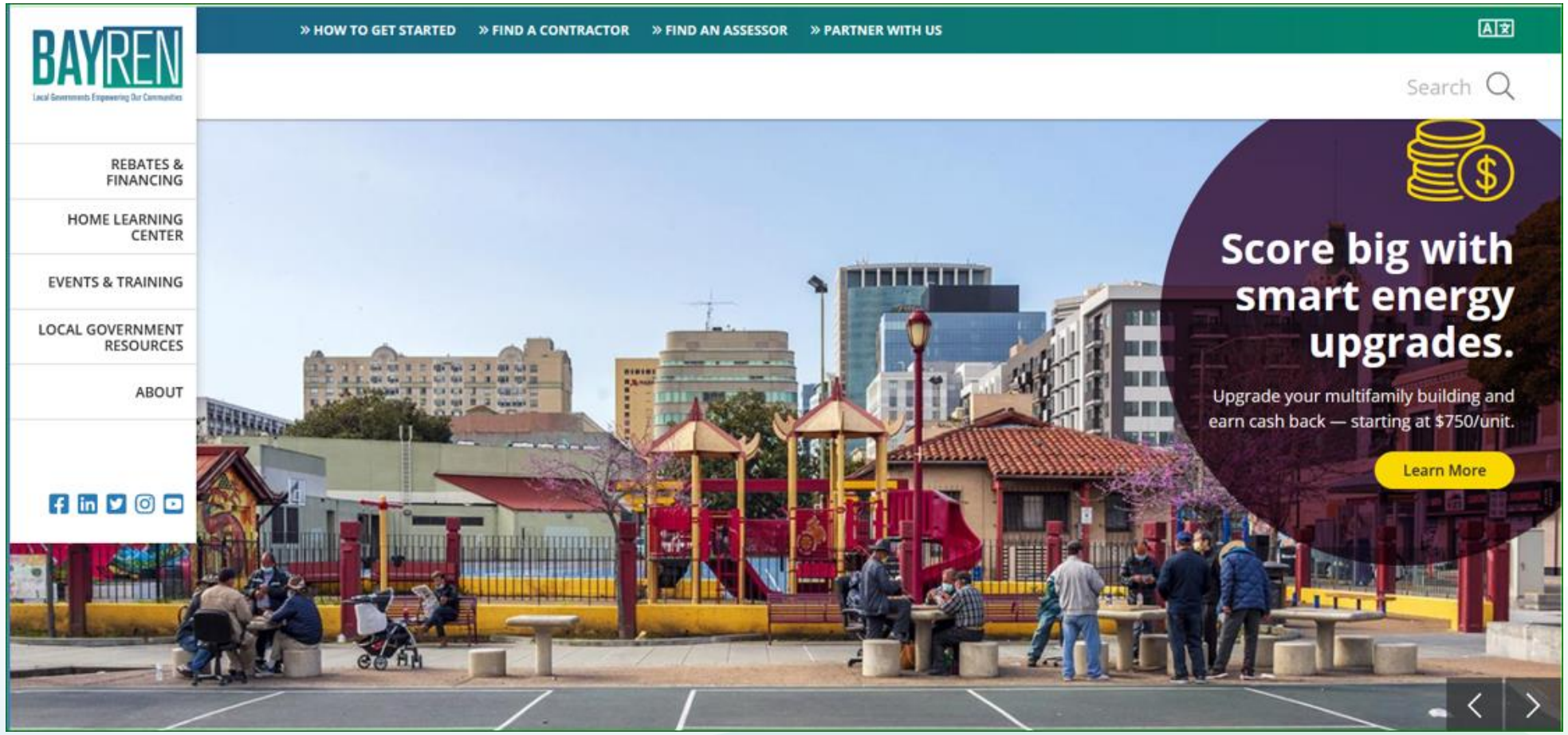
- Title24@energy.ca.gov

Other Available Resources – Energy Code Ace

Other Available Resources – 3C-REN



Other Available Resources – BayREN



Other Available Resources –
Inland Regional Energy Network (I-REN)

iren.gov
info@iren.gov

Codes and Standards

Training and Education Program

- Free ICC-approved training sessions for 2022 Energy Code (Title 24, Part 6) requirements → www.iren.gov/161/CS-Trainings
- Requested training courses can also be scheduled

C&S Technical Support Program

Request Free Technical Assistance from Local Code Experts—Reach Code Development, Permit Guides, Etc. → www.iren.gov/162/CS-Technical-Support

Ask a Code Mentor an Energy Code Question

Submit queries online and receive a personalized response addressed by energy code experts within two business days! → www.iren.gov/162/CS-Technical-Support

I·REN INLAND REGIONAL ENERGY NETWORK = CVAG sbcog San Bernardino Council of Governments WRCOG Western Riverside Council of Governments

Coachella Valley Association of Governments (CVAG)
San Bernardino Council of Governments (SBCOG)
Western Riverside Council of Governments (WRCOG)

* Not affiliated with, or endorsed by, the CEC

Thank you