Ace Resources | Title 24, Part 6 Fact Sheet

Single-family Buildings

HVAC Additions and Alterations

What's Included in this Fact Sheet?

In the 2022 California Building Energy Efficiency Standards (Energy Code or Title 24, Part 6), single-family buildings include single-family homes, accessory dwelling units (ADUs), duplexes and townhomes of any height.

A heating, ventilation and air conditioning (HVAC) Alteration is any change to an existing home's HVAC system that is regulated by the 2022 Energy Code. An Addition is any change to a building that increases conditioned floor area and conditioned volume.

How Does this Fact Sheet Apply to Your Project?

Use this fact sheet to answer these questions about an HVAC project in an existing home:

1. What requirements does your project need to meet to comply with the Energy Code?
2. Who's involved in the compliance process?
3. How should you document your project's compliance?

Importance of Compliance

The 2022 Energy Code is an important part of California's work to reduce carbon emissions and fight climate change. The Energy Code is updated every three years with the mandate to increase building energy efficiency while staying cost-effective for building owners over the lifespan of a building.

Increases in energy efficiency:

- Reduce utility bills
- Improve indoor comfort and air quality
- Increase market value
- Reduce greenhouse gas emissions

For single-family homes, the California Energy Commission (CEC) estimates that the 2022 Energy Code change from using natural gas furnaces to electric heat pumps to heat new homes for most climate zones reduce net CO2 emissions by 16,230 mTon/yr compared to the 2019 Energy Code, the equivalent of taking 3,641 gas cars off the road each year.

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Where to Find Certified Products

§§110.1, 110.2(a)

Mandatory Requirements

The National Appliance Efficiency Conservation Act (NAECA) and/or the California Appliance Efficiency Regulations (Title 20) regulate most heating and cooling equipment installed in California homes.

Installers should confirm and document that only certified products are installed. Use the Product Finder and Modernized Appliance Efficiency Database System (MAEDbS) tools to find certified products.

ECA Product Finder bit.ly/eca-product-finder (MAEDbS) bit.ly/MAEDbS

Heating and Cooling Systems

Key Terms

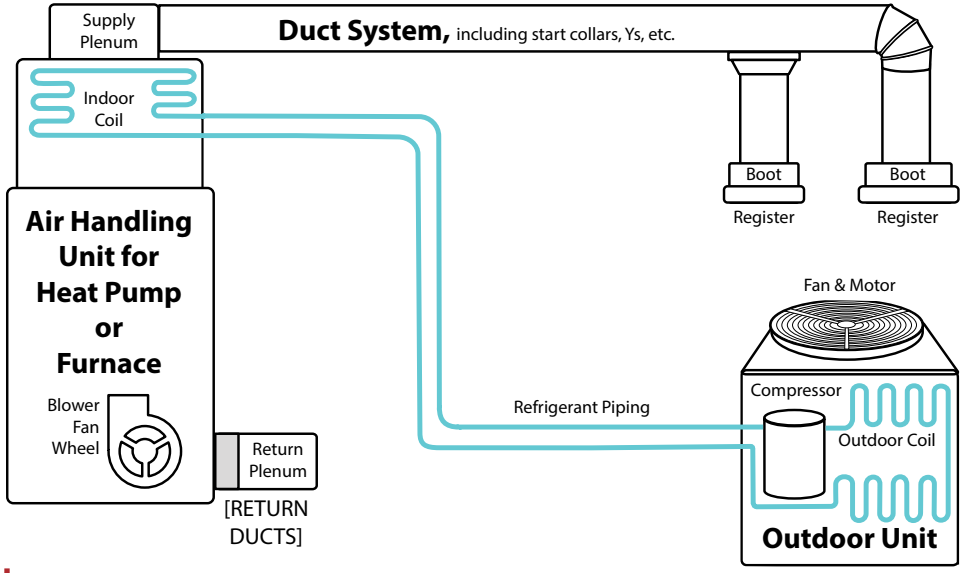

Figure 1. *Split System: Heat Pump or Gas Furnace*

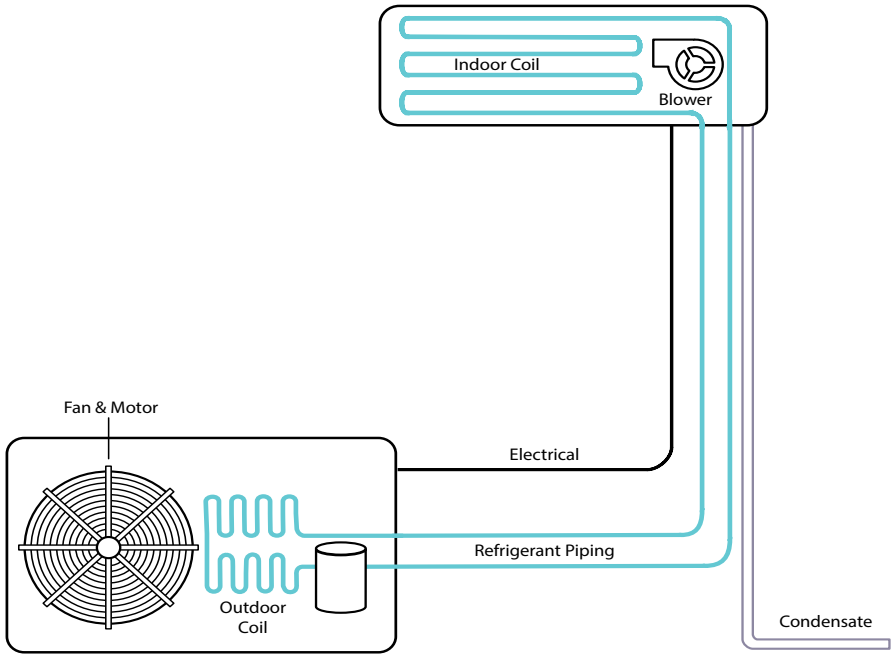

Figure 2. *Split System: Ductless Mini-split System, Heat Pump or Cooling Only*

Addition, Alteration or Repair?

An Addition adds new conditioned floor area and conditioned volume.

Alterations make changes to existing systems that may trigger Energy Code requirements, but Repairs do not.

Replacing some components may be considered a Repair instead of an Alteration. For example, replacing the fan blower wheel or fan blower motor in an air handler are considered Repairs, so those changes do not trigger the Energy Code.

Key Terms (continued)

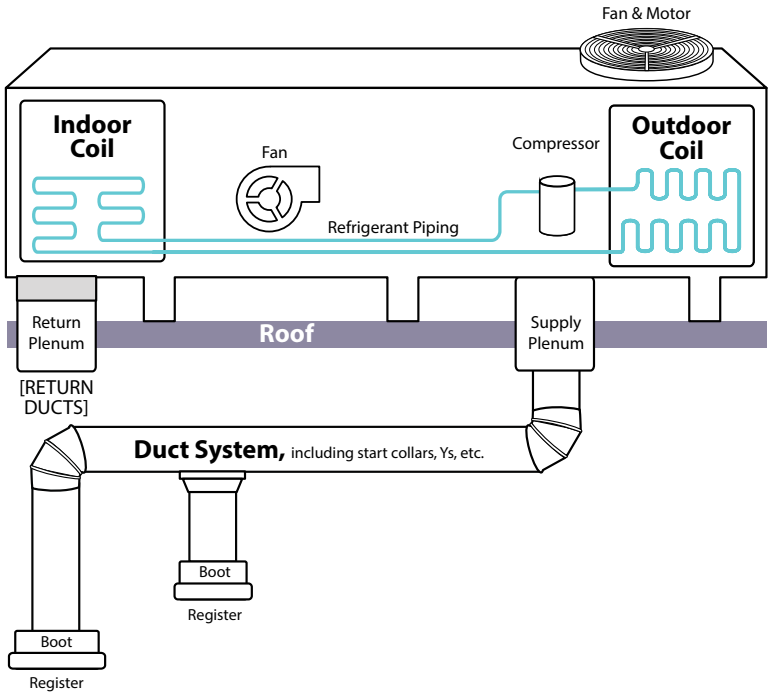

Figure 3. *Packaged System: Heat Pump or Gas Furnace*

Energy Code and Common Terms for HVAC Systems

Energy Code Term	Common Term	Definition
New or Replacement Space-conditioning System	Cut-in (dry wall work, framing construction work)	When all of a system's heating and cooling components are installed or replaced and ≥ 75% of the duct system is entirely new or replaced
Altered Space-conditioning System	Change-out	When one or more of the following components is installed or replaced: ✦ Air handler (includes furnaces and package units) ✦ Outdoor condensing unit ✦ Cooling or heating coil ✦ Any refrigerant-containing component, including a condenser coil, compressor, refrigerant piping or refrigerant-metering device (e.g., TXV)
Entirely New or Replacement Duct System	Re-duct	When ≥ 75% of a duct system is new or replaced and all existing ducts are accessible and can be sealed
Altered Duct System	Change, replace, add or alter ducts	When < 75% of a duct system is new or replaced

Table 1. *Energy Code and Common Terms for HVAC Systems*

Trigger Table

Requirement Type	Heating and Cooling Equipment			Distribution System						Controls
	Mandatory	Prescriptive		Mandatory				Prescriptive		Mandatory
For details, click a requirement title or code section → **Project Scope: Change this and nothing else**	Cooling & Heating Load §150.0(h) §150.2(a)	HERS-verified Refrigerant Charge §150.1(c)7 §150.2(b)1F	Heat Pump Space Heater §150.1(c)6	HERS-verified Airflow Rate① §150.0(m)13 §150.2(b)1C-F	HERS-verified Fan Efficacy §150.0(m)13 §150.2(b)1	HERS-verified Duct Leakage② §150.2(b)1	Air Filter §§150.0(m) 12-13 §§150.2(b) 1C-D	Duct Insulation §150.2(b)1D	Ceiling Insulation §150.2(b)1J	Setback Thermostat §110.2(c) §150.0(i) §150.2(b)1F
Install an entirely new or replacement space-conditioning system, including air conditioning and ducting③	**YES**	**YES** if AC	No	**YES** if AC	**YES** if AC	**YES**	**YES**	**YES**	**YES**④	**YES**
Replace all HVAC equipment but no new ductwork (for example, a furnace could be changed out for a heat pump)	No	**YES** if AC	No	**YES** if HERS Refrigerant Charge required	No	**YES**	No	No	No	**YES** if AC or heat pump
Add a ductless mini-split system, heat pump or cooling only	No	**YES**	No	No	No	No	No	No	No	**YES**
Replace an air handler (for example, a furnace or fan coil)	No	No	No	No	No	**YES**	No	No	**YES**④	No
Replace any refrigerant-containing system components (compressor, condensing coil, evaporator coil, refrigerant-metering device or refrigerant piping)⑤	No	**YES**	No	**YES** if HERS Refrigerant Charge required	No	**YES**⑥	No	No	No	**YES**
Replace belts, fan blower wheel and/or electrical components (Repair)	No	No	No	No	No	No	No	No	No	No
Replace or add a room heating or air-conditioning unit	No	No	No	No	No	No	No	No	No	No⑦

Table 2. *Energy Code Triggers in Heating and Cooling System Additions and Alterations in Single-family Buildings (continued)*

Continued on next page →

Trigger Table (continued)

Requirement Type	Heating and Cooling Equipment			Distribution System						Controls
	Mandatory	Prescriptive		Mandatory				Prescriptive		Mandatory
For details, click a requirement title or code section → **↓ Project Scope: Change this and nothing else**	Cooling & Heating Load §150.0(h) §150.2(a)	HERS-verified Refrigerant Charge §150.1(c)7 §150.2(b)1F	Heat Pump Space Heater §150.1(c)6	HERS-verified Airflow Rate① §150.0(m)13 §150.2(b)1C-F	HERS-verified Fan Efficacy §150.0(m)13 §150.2(b)1	HERS-verified Duct Leakage② §150.2(b)1	Air Filter §§150.0(m) 12-13 §§150.2(b) 1C-D	Duct Insulation §150.2(b)1D	Ceiling Insulation §150.2(b)1J	Setback Thermostat §110.2(c) §150.0(i) §150.2(b)1F
Install an entirely new or replacement duct system⑧	No	No	No	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**④	No
Add or replace < 75% and > 25 ft of ducting for an existing system	**YES** to verify existing HVAC meets heating load if for an Addition	No	No	No	No	**YES**	No	**YES**	No	No
Add < 25 ft of new ducting to an existing system	**YES** to verify existing HVAC meets heating load if for an Addition	No	No	No	No	**YES** if ducts in garage, otherwise no	No	**YES**	No	No

✦ Replacing the fan blower wheel and similar repairs are considered Repairs and do NOT trigger the Energy Code.

✦ All new HVAC equipment must meet minimum federal efficiency requirements.

✦ Refrigerant line insulation requirements are triggered if the line set (cooling system, suction line) is replaced or repaired. Line sets ≤ 1.5" in diameter must have 0.75" thick insulation.

Table 2. *Energy Code Triggers in Heating and Cooling System Additions and Alterations in Single-family Buildings (continued)*

Continued on next page →

Trigger Table (continued)

Trigger Table Notes

① HERS verification applies to new forced air ducted systems with cooling and altered systems in which refrigerant charge is required. Completely new systems (equipment and ducting) can use the return grille option per Table 150.0-B or C or be verified per HERS verification of airflow: 0.45 W/CFM for gas furnace air-handling units (manufactured as of July 3, 2019) and 0.58 W/CFM for air-handling units that are not gas furnaces (i.e., heat pumps).

② A new or complete replacement duct system in a single-family building must demonstrate a leakage rate of ≤ 5% of the system air handler airflow. Extension of an existing duct system > 25 ft or Alterations (partial replacements) must demonstrate a leakage rate of ≤ 10%. If the sealing requirements cannot be met, all accessible leaks must be sealed and verified by a HERS Rater. HERS duct testing is not required when asbestos is present. If any portion of the HVAC system (including ducts, air-handling units, cooling or heating coils, or plenums) is located in a garage space, the ducts must be sealed and have HERS verified leakage of ≤ 6%.

③ An Alteration is considered an "entirely new or replacement duct system" when an "entirely new or replacement duct system" is combined with all new equipment.

④ Ceiling insulation and sealing requirements are triggered when both an air handler and ducting are completely replaced within a vented attic in Climate Zones 1-4, 6 or 8-16.

⑤ Refrigerant-containing system components include the compressor, condensing coil, evaporator coil, refrigerant metering device or refrigerant piping.

⑥ Duct leakage testing for refrigerant-containing systems applies only to the installation or replacement of an air handler, outdoor condensing unit of a split-system air conditioner or heat pump, or cooling or heating coil.

⑦ Setback thermostats are not required for 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.

⑧ An Alteration is considered an "entirely new or replacement duct system" when 75% or more of the ducts are new or replaced and the existing ducts are accessible and can be sealed. If the existing ducts are not accessible, it does not meet the definition. The ceiling insulation requirements of §150.2(b)1J may be triggered when ducts are installed in a vented ceiling. See §150.2(b)1Diia.

Additional Requirements

Electric resistance heating is allowed to be added to a home as a supplemental heating unit that is installed in a space served directly or indirectly by a primary heating system only when the unit has a thermal capacity ≤ 2 kW or ≤ 7,000 Btuh and a timer limiting operation to 30 minutes or less. Ducted electric resistance heating can be left in place if existing but cannot be added or replaced. Heat pump equipment can always replace gas or electric resistance heating equipment. §150.1(c)6

All HVAC equipment must be certified through Title 20 Appliance Efficiency Standards or Title 24 Part 6, §§110.1 or 110.2 that they meet the minimum efficiency requirements at either the time of purchase or installation as called out by federal regulations which are updating January 1, 2023.

When an entirely new or complete replacement duct system is installed (ducts with or without new equipment) **and has > 10 ft of ducting,** air filters must be 2" MERV-13. Alternative filter options may be applied with careful duct design sizing methodologies. §§150.0(m)12, 150.2(b)1C and 150.2(b)1Diia

Condensers must have a minimum 5 ft clearance from dryer vent outlets. §150.0(h)3

Refrigerant pipe insulation and protection is required of all new piping. §150.0(j)

When HERS refrigerant charge verification is required Prescriptively, a demand-responsive HVAC control (Wi-Fi thermostat that can be accessed remotely) may be required if outdoor temperatures are less than 55°F and the weigh-in method is used for verification. This should be confirmed with HERS Rater. §150.2(b)1Fiib

Factory-charged packaged systems for which the manufacturer has verified the correct system refrigerant charge prior to shipment from the factory do not require HERS verification of refrigerant charge. §150.1(c)7A

When the duct system is entirely inside conditioned space and confirmed by a HERS Rater, the Performance Method allows uninsulated duct for new ducting minimum insulation. Portions of the duct that are completely exposed to and surrounded by directly conditioned space are not required to be insulated. §150.0(m)

New ducting in unconditioned spaces is Prescriptively required to have minimum insulation of R-8 in Climate Zones 2, 4 and 8-16 and R-6 in Climate Zones 3 and 5-7. §150.2(b)1D

Heat pump equipment must use controls so that supplementary electric resistance strip heating is secondary to the heat pump operation. §110.2(b)

Furnaces ≥ 225,000 Btuh, including electric furnaces, which are not located within the conditioned space must have jacket losses not exceeding 0.75% of the input rating. They must also have an intermittent ignition or interrupted device (IID) and have either power venting or a flue damper. A combustion air intake vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. A setback thermostat or an energy management control system (EMCS) must be programmed to provide, at a minimum, functionality required of a setback thermostat. §110.2(d)

Table 2. *Energy Code Triggers in Heating and Cooling System Additions and Alterations in Single-family Buildings (continued)*

Heating and Cooling Equipment

Heating and Cooling Load Calculations

§§150.0(h), 150.2(a)

Mandatory Requirements

Commonly Applicable Project Scopes

Heating and cooling calculations are required when:

- Ducts are added to or replaced in an existing system for an Addition.
- All of a system's heating and cooling components and ≥ 75% of a duct system are installed or replaced, and the equipment serves an existing home and Addition.

Non-applicable Projects and Exceptions

Load calculations are not required when replacement equipment is the same size as that being removed and is not associated with an Addition.

Requirements

To determine heating and cooling loads, use a method based on any one of the following:

- ASHRAE Handbook, Equipment Volume, Applications Volume and Fundamentals Volume
- SMACNA Residential Comfort System Installation Standards Manual
- ACCA Manual J

Heat Pump Space Heater

§§150.1(c)6; 150.2(a) Exception #7; 150.2(b)1C

Prescriptive Requirements

Commonly Applicable Project Scopes

Heat pump space heaters are required for new single-family homes, townhomes or New Construction detached ADUs in Climate Zones 3, 4, 13 and 14.

Non-applicable Projects and Exceptions

A heat pump space heater will not be required for altered or replacement equipment, for new equipment serving an Addition, or for projects when compliance has been achieved using the Performance Approach.

Requirements

Heat pump space heaters must meet applicable minimum efficiency requirements.

When a supplemental electric resistance heater is used within the heat pump heater, the §110.2(b) control requirements must also be met.

Ace Tips

Best Practice for Verifying Refrigerant Charge

Coordinate with the HERS Rater to ensure that the HERS Rater is present to witness when you at start up the system.

If the HERS Rater is not present, you will need to run through the manufacturer's charge procedure twice, once at start-up with the wet condenser and again for the HERS Rater starting with a dry system.

HERS-verified Refrigerant Charge

§§150.1(c)7, 150.2(b)1F

Prescriptive Requirements

Commonly Applicable Project Scopes

Home Energy Rating System (HERS) Rater-verified refrigerant charge is required in Climate Zones 2 and 8-15 when:

- Any refrigerant-containing system components such as the compressor, condensing coil, evaporator coil, refrigerant-metering device or refrigerant piping are replaced.
- All HVAC equipment is new or replaced or has altered or replaced refrigerant containing parts, including ductless air-conditioning systems.
- A ductless mini-split equipment is added or replaced.

Non-applicable Projects and Exceptions

The following systems do not require HERS verification of the refrigerant charge:

- Packaged systems for which the manufacturer has verified the refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing.
- The HVAC system is in Climate Zone 1, 3-7 or 16.

Continued on next page

HERS-verified Refrigerant Charge (continued)

Requirements

A HERS Rater must verify that the system contains the correct amount of refrigerant as specified by the manufacturer following the instructions in §150.1(c)7A.

Ducted DX split systems can use either of the approved methods for refrigerant charge verification:

- RA3.2.2 Standard Charge Verification Procedure
- RA3.2.3 Weigh-In Charging Procedure

Ductless mini-splits can be verified using only the weigh-in method. Coordinate with your HERS Rater to witness the start-up to verify that the manufacturer's instructions were followed for the charge adjustment based on the condenser charge and adjustments for line set length. If the HERS Rater is not present to witness the entire process at start-up, then additional steps have to be taken to verify the charge. This process includes recovering all of the refrigerant from the system and having the HERS Rater witness the entire process for charging a dry system according to the manufacturer's instructions.

Distribution System

HERS-verified Airflow Rate

§§150.0(m)13, 150.2(b)1C-F

Mandatory Requirements

Commonly Applicable Project Scopes

HERS verification of airflow rate is required for ducted, mechanical cooling systems when:

- HERS verification of the refrigerant charge is required because either
- Any refrigerant-containing system components such as the compressor, condensing coil, evaporator coil, refrigerant-metering device or refrigerant piping is replaced.

  --or--
- All HVAC equipment, including air-conditioning equipment, is replaced, with or without adding or replacing ductwork.
- An entirely new or replacement duct system is installed in which ≥ 75% of the duct system is new or replaced.

Non-applicable Projects and Exceptions

Residential Appendix RA3.3.3.1.5 provides remedial actions as an alternative to compliance with minimum airflow for alerted systems.

Requirements

A HERS Rater must verify that the airflow rate meets the requirements in Table 3 following the procedures in Reference Residential Appendix RA3.3:

- RA3.3.3.1.1 Airflow Measurement Using Plenum Pressure Matching Method (duct blaster air flow test)
- RA3.3.3.1.2 Airflow Measurement Using Flow Grid
- RA3.3.3.1.3 Airflow Measurement Using Powered Flow Capture Hood
- RA3.3.3.1.4 Airflow Measurement Using Traditional Flow Capture Hood

System Type	Required Airflow Rate
Single Zone Central Forced Air System	≥ 350 CFM per ton of nominal cooling capacity through the return grilles
Zonally Controlled Central Forced Air System	≥ 350 CFM per ton of nominal cooling capacity
Small Duct High-velocity Forced Air System	≥ 250 CFM per ton of nominal cooling capacity through the return grilles

Table 3. *Required Airflow Rates by HVAC System Type in Single-family Building Additions and Alterations*

HERS-verified Fan Efficacy

§§150.0(m)13, 150.2(b)1

Mandatory Requirements

Commonly Applicable Project Scopes

HERS verification of air-handling unit fan efficacy is required for ducted, mechanical cooling systems when:

- An entirely new or replacement duct system is installed in which ≥ 75% of the duct system is new or replaced.
- All HVAC equipment, including air-conditioning equipment, is replaced, including an entirely new or replacement duct system in which ≥ 75% of the duct system is new or replaced.

Non-applicable Projects and Exceptions

Fan efficacy is not required to be HERS verified for:

- Alterations that are not new or replacement
- Ductless systems

Requirements

A HERS Rater must verify that the air-handling unit fan efficacy meets the requirements in Table 4 following the procedures in Reference Residential Appendix RA3.3:

- RA3.3.3.2.1 Air Handler Watt Draw Measurement Using Portable Watt Meter
- RA3.3.3.2.2 Air Handler Watt Draw Measurement Using Utility Revenue Meter
- RA3.3.3.2.3 Air Handler Watt Draw Measurement Using Digital Utility Revenue Meter

System Type	Fan Efficacy
Single Zone Central Forced Air System	
Gas Furnace Air-handling Unit	≤ 0.45 W/CFM
Other Air-handling Unit	≤ 0.58 W/CFM
Zonally Controlled Central Forced Air System	
Gas Furnace Air-handling Unit	≤ 0.45 W/CFM
Other Air-handling Unit	≤ 0.58 W/CFM
Small Duct High-velocity Forced Air System	≤ 0.62 W/CFM

Table 4. *Required Air-handling Unit Fan Efficacy by HVAC System Type in Single-family Building Additions and Alterations*

HERS-verified Duct Leakage

§150.2(b)1

Mandatory Requirements

Commonly Applicable Project Scopes

Duct leakage testing may be required for altered HVAC systems when:

- A new, ducted HVAC system with ducting of any length is added to an existing home.
- Any new or replaced ducts are installed in garage spaces.
- > 25 ft of ductwork is replaced or added to an existing system.
- An entirely new or replacement duct system is installed in which ≥ 75% of the duct system is new or replaced and all existing ducts are accessible and can be sealed.
- Certain refrigerant-containing components are installed or replaced, limited to the air handler, outdoor condensing unit of a split-system air conditioner or heat pump, or cooling or heating coil.

Non-applicable Projects and Exceptions

Although not explicitly excepted in the Energy Code, duct leakage testing requirements do not apply to ductless air-conditioning systems.

Requirements

A HERS Rater must verify that measure duct leakage meets the requirements in Table 5 as verified with the following procedures from the Reference Residential Appendix RA3.1:

- RA3.1.4.3.2.1 Air handling unit Installed and Connected Total Leakage Test
- RA3.1.4.3.4 Duct Leakage to Outside
- RA3.1.4.3.5 Sealing of All Accessible Leaks
- RA3.1.4.3.6 Smoke-Test of Accessible Duct Leak Sealing (for existing ducts that cannot pass)

Projects that trigger HERS-verified duct leakage testing requirements may trigger additional Energy code requirements. See Table 5 below for these additional requirements.

For these Project Scopes	Measured Leakage Is Limited to	Additional Energy Code Requirements
Extension of Existing Ducts: **> 25 ft of new or replacement ducts installed to extend an existing system**	≤ 10% of system air handler air flow For exceptions or alternatives, consult your Building Department or §150.2(b)1Diib.	
Altered Space-conditioning System	≤ 10% of system air handler air flow For exceptions or alternatives, consult your Building Department or §150.2(b)1Diib.	**HERS-verified Airflow Rate** **HERS-verified Refrigerant Charge** for ducted, mechanical cooling systems in Climate Zones 2 and 8-15
New/Replacement Duct System	≤ 5% of the system air handler airflow	**HERS-verified Airflow Rate** **HERS-verified Fan Efficacy** **HERS-verified Refrigerant Charge** for ducted, mechanical cooling systems in Climate Zones 2 and 8-15
Altered Ducts in Garage Spaces	≤ 6% of system air handler air flow	
If measuring leakage is not possible: §150.2(b)1Eiii *specifies that all accessible leaks must be sealed and verified through a visual inspection and smoke test by a certified HERS Rater using the methods specified in Reference Residential Appendix RA3.1.4.3.5.*		

Table 5. *Duct Leakage Limits and Additional Requirements for Single-family Building Additions and Alterations*

Residential Space Heating/Cooling and Water Heating Equipment Minimum Efficiencies

Heat Pumps <65,000 Btuh – Minimum Heating and Cooling Efficiencies

Table 1 applies to single-phase air source heat pumps with a cooling capacity <65,000 Btuh.
See Table 2 for non-heat pump air conditioners.

Configuration	Manufactured BEFORE 1/1/2023		Manufactured ON or AFTER 1/1/2023*	
	HSPF	SEER	HSPF2	SEER2
Packaged	8.0	14.0	6.7	13.4
Split (including ductless)	8.2	14.0	7.5	14.3
Space-constrained ❶	7.4	12.0	6.3	11.9
Small Duct High-velocity	7.2	12.0	6.1	12.0

HSPF = *heating season performance factor;* ***SEER =*** *seasonal energy efficiency ratio.*

* Systems manufactured on or after 1/1/2023 must meet the newer HSFP2/SEER2 requirements and cannot use HSPF or SEER.

Table 1. *Adapted from the Code of Federal Regulations, per 10 CFR 430.32(c)*

Central Air Conditioners (not Heat Pumps) <65,000 Btuh – Minimum Cooling Efficiencies

Configuration	Rated Cooling Capacity (Btuh)	Installed BEFORE 1/1/2023		Installed ON or AFTER 1/1/2023*	
		SEER	EER	SEER2	EER2
Split System	<45,000	14.0	12.2	14.3	11.7/9.8**
	≥45,000	14.0	11.7	13.8	11.2/9.8**
Single Package	<65,000	14.0	11.0	13.4	10.6
Space-constrained ❶	<30,000	12.0***	no minimum	11.7***	no minimum

SEER = *seasonal energy efficiency ratio;* ***EER =*** *energy efficiency ratio.*

* Regardless of manufacture date, systems installed on or after 1/1/2023 must meet the newer SEER2/EER2 requirements and cannot use SEER or EER.
** For systems with 15.2 SEER2 or greater, the minimum EER2 requirement is 9.8.
*** Use the manufacture date, not installation date, for space-constrained units.

Table 2. *Adapted from the Code of Federal Regulations, per 10 CFR 430.32(c)*

Gas- and Oil-fired Central Furnaces – Minimum Heating Efficiencies

Appliance	Rated Input (Btuh)	Minimum Efficiency (%)	
		AFUE	TE
Weatherized Gas Central Furnaces with Single Phase Electrical Supply	<225,000	81%	—
Non-weatherized Gas Central Furnaces with Single Phase Electrical Supply	<225,000	80%	—
Weatherized Oil Central Furnaces with Single Phase Electrical Supply	<225,000	78%	—
Non-weatherized Oil Central Furnaces with Single Phase Electrical Supply	<225,000	83%	—
Gas Central Furnaces	≥225,000	—	81%
Oil Central Furnaces	≥225,000	—	82%

AFUE = *annual fuel utilization efficiency;* ***TE =*** *thermal efficiency.*

Table 3. *Adapted from the California Appliance Efficiency Regulations Title 20, Tables E-5 and E-6*

Federally Regulated Residential Water Heaters — Minimum Domestic Hot Water (DHW) Efficiencies

Product Class	Rated Storage Volume (Gallons)	Draw Pattern	Uniform Energy Factor (UEF) Minimum Requirement
Consumer Gas-fired Instantaneous (≤200,000 Btuh)	≤2	Low/Medium/High	0.81
Consumer Gas-fired Storage (≤75,000 Btuh)	40	Medium	0.58
	50		0.56
	60		0.77
	70		0.76
	80		0.76
	40	High	0.64
	50		0.63
	60		0.79
	70		0.79
	80		0.78
Residential-duty Commercial Gas-fired Storage (>75,000 Btuh, ≤105,000 Btuh)	50	Medium	0.55
	60		0.53
	70		0.52
	80		0.51
	50	High	0.61
	60		0.61
	70		0.59
	80		0.59
Consumer Electric Instantaneous (≤12 kW)	≤2	Very Small/Low/ Medium	0.91
Electric Grid-enabled Storage (≤12 kW)	80	High	0.92
	90		0.91
	100		0.90
Electric Storage (including Heat Pump) (≤12 kW)	40	Medium	0.92
	50		0.92
	60		2.05
	40	High	0.93
	50		0.93
	60		2.18

Table 4. *Adapted from the Code of Federal Regulations, per 10 CFR 430.32(d)*

1 A space-constrained product means a central air conditioner or heat pump that:

(1) Has a rated cooling capacity ≤30,000 Btuh

(2) Is a product type that was available for purchase in the United States as of December 1, 2000

(3) Has an outdoor or indoor unit having at least two overall exterior dimensions or an overall displacement that:

a. Are substantially smaller than those of other units that are both
   i. Currently usually installed in site-built single-family homes
   ii. Has a similar cooling, and, if a heat pump, heating, capacity

b. If increased, would certainly result in a considerable increase in the usual cost of installation or would certainly result in a significant loss in the utility of the product to the consumer

This program is funded by California utility customers and administered by Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E®), and Southern California Edison Company (SCE) under the auspices of the California Public Utilities Commission.

Air Filter

§§150.0(m)12-13, 150.2(b)1C-D, 150.2(b)1Diia

Mandatory Requirements

Commonly Applicable Project Scopes

Heating and cooling systems have air filtration requirements when:

- An entirely new or replacement duct system is installed in which ≥ 75% of the duct system is new or replaced.
- All HVAC equipment is replaced, including an entirely new or replacement duct system in which ≥ 75% of the duct system is new or replaced.
- Any new, ducted system has ducting > 10 linear feet.

Non-applicable Projects and Exceptions

Although not explicitly excepted in the Energy Code, air filter requirements do not apply to the following systems:

- Ductless systems
- HVAC systems with < 10 ft of ducting

Requirements

Air filtration must be installed as described in §150.0(m)12.
Take special note of these two requirements:

- Filter racks or grilles must use gaskets, sealing or other means to close gaps around inserted filters.
- Air filters must have either:
  - ◊ Designated ≥ MERV 13 efficiency, when tested in accordance with ASHRAE Standard 52.2
    --or--
  - ◊ Particle size efficiency rating ≥ 50% in the 0.30-1.0 µm range and ≥ 85% in the 1.0-3.0 µm range, when tested in accordance with AHRI Standard 680

Air filters must be 2" MERV-13 when an entirely new or complete replacement duct system is installed (ducts with or without new equipment) and has > 10 ft of ducting. Alternative filter options may be applied with careful duct design sizing methodologies. §§150.0(m)12, 150.2(b)1C and 150.2(b)1Diia

Duct Insulation

§150.2(b)1D

Prescriptive Requirements

Commonly Applicable Project Scopes

Duct insulation requirements are triggered when:

- Any length of ductwork is replaced or added to an existing system.
- An entirely new or replacement duct system is installed in which ≥ 75% of the duct system is new or replaced and all existing ducts are accessible and can be sealed.
- An entirely new or replacement heating and cooling system is installed in which ≥ 75% of the duct system is new or replaced and all existing ducts are accessible and can be sealed.

Non-applicable Projects and Exceptions

There are no exceptions.

Requirements

All altered ducts must meet the insulation and construction requirements of Table 6, below.

Climate Zone	Duct R-value
3, 5, 6, 7	R-6
1, 2, 4, 8-16	R-8
Copied from Table 150.2-A	

Table 6. *Duct Insulation R-value by Climate Zone*

Ace Tips

Duct Insulation Pro Tip

Many businesses have discovered it is better to stock only R-8 insulation for all ducted jobs.

Reducing how many items you have to stock, track and order reduces administrative overhead costs. Most Climate Zones prescriptively require R-8, and your clients in the other Climate Zones will appreciate having a higher performing system than the minimum would require.

Controls

Ceiling Insulation

§150.2(b)1Diia and 150.2(b)1J

Mandatory Requirements

Commonly Applicable Project Scopes

A project triggers ceiling insulation and sealing requirements of §150.2(b)1J when:

- **Both** an air handler **and** ducting complete replacement are done within a vented attic in Climate Zone 1-4, 6 or 8-16.

Non-applicable Projects and Exceptions

- This requirement does not apply to Climate Zones 5 and 7.
- In Climate Zones 1, 3 and 6, ceiling Alterations do not need to meet the requirements of §150.2(b)1J if there is existing R-19 insulation verified at the ceiling.

Requirements

In Climate Zones 1-4, 6 and 8-16, ceiling Alterations to vented attics must have an overall weighted U-factor of maximum 0.020 or R-49 insulation at the ceiling.

A project may have additional requirements to meet, based on its Climate Zone. See Table 7 for these additional requirements and exceptions to them.

Projects in these Climate Zones	Must Meet these Additional Requirements	Unless these Exceptions Apply
2, 4 and 8-16	§150.2(b)1Jii: Air seal all accessible areas of the ceiling plane between the attic and the conditioned space in accordance with §110.7.	The ceiling level has existing R-19 insulation. Vented space- or water-heating combustion appliances are located inside the dwelling unit.
1-4 and 8-16	§150.2(b)1Jiii: Cover recessed downlight luminaires in the ceiling with insulation to the same depth as the rest of the ceiling. Replace or retrofit luminaires not rated for insulation contact with a fire-proof cover that allows for insulation to be installed directly over the cover.	The ceiling level has verified R-19 or greater insulation in Climate Zones 1-4 or 8-10.
1-16	§150.2(b)1Jiv: Ensure that attic ventilation complies with California Building Code requirements.	The ceiling level has existing R-19 or greater insulation. There is an asbestos disturbance risk. Knob and tube wiring are present in the vented attic. Accessible attic space is too small to insulate to the required R-value without violating Section 806.3 of Title 24, Part 2.5. The attic space is shared with other dwelling units that are not triggered for §150.2(b)1J.

Table 7. *Additional Requirements for Altered Ceiling Insulation in Single-family Building Additions and Alterations*

Setback Thermostat

§§110.2(c), 150.0(i), 150.2(b)1F

Mandatory Requirements

Commonly Applicable Project Scopes

- Only altered or new/replacement cooling systems trigger installation of setback thermostats.
- A setback thermostat is required when:
  - Any refrigerant-containing system components such as the compressor, condensing coil, evaporator coil, refrigerant-metering device or refrigerant piping is replaced.
  - All HVAC equipment is replaced, without adding or replacing ductwork.

Non-applicable Projects and Exceptions

A setback thermostat is not required for the following:

- A project replaces a room heating or cooling unit, such as a gravity gas wall heater, gravity floor heater, gravity room heater, non-central electric heater, fireplace or decorative gas appliance, wood stove, room air conditioner and room air-conditioner heat pump.
- A heating system is controlled by a central energy management control system (EMCS). §150.0(i)

Requirements

For heating or cooling systems which require a setback thermostat, the requirements are provided in detail in §110.2(c).

Ventilation Systems

Key Terms

The Energy Code ventilation requirements for single-family buildings are based on ASHRAE 62.2. For whole-building dwelling-unit ventilation, ASHRAE 62.2 Section 4 dictates a minimum airflow, control and sound rating requirements.

ASHRAE 62.2 Section 5 Local Exhaust requires that local mechanical exhaust must be installed in each kitchen and bathroom meeting minimum airflow, control and sound rating requirements.

Term	Definition
Whole-house Mechanical Ventilation	An exhaust system, supply system or combination of those systems that is designed to mechanically exchange indoor air for outdoor air where operating continuously or through a programmed intermittent schedule to satisfy the whole house ventilation rate
Local Exhaust	An exhaust system that uses one or more fans to exhaust air from a specific room within a dwelling
Exhaust Air	Air discharged from any space to the outside by an exhaust system
Indoor Air Quality (IAQ)	The air quality within and around buildings related to pollutant levels, odors, temperature, humidity and other factors affecting the health and comfort of occupants
ASHRAE 62.2	American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 62.2 "Ventilation and Acceptable Indoor Air Quality in Residential Buildings," 2019

Table 8. *Energy Code and Common Terms for Ventilation Systems*

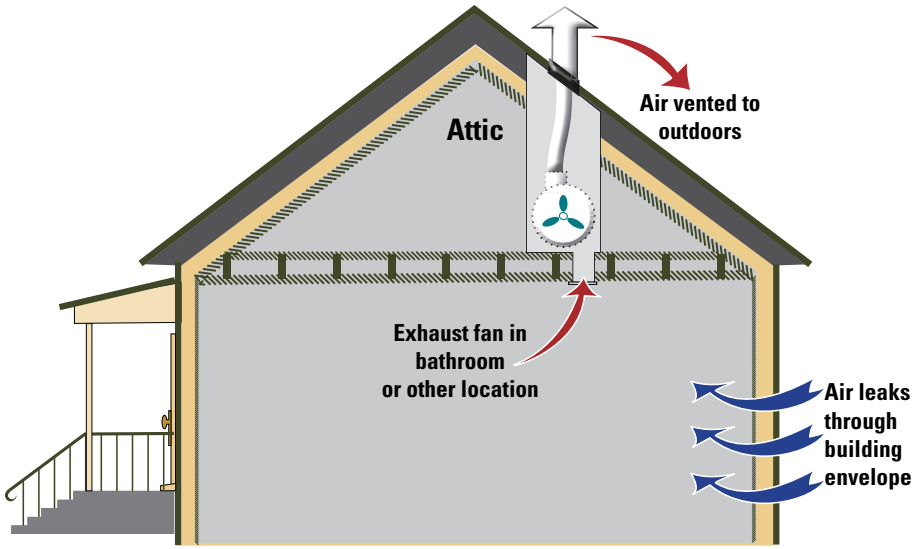

Figure 4. *Exhaust Ventilation Example*

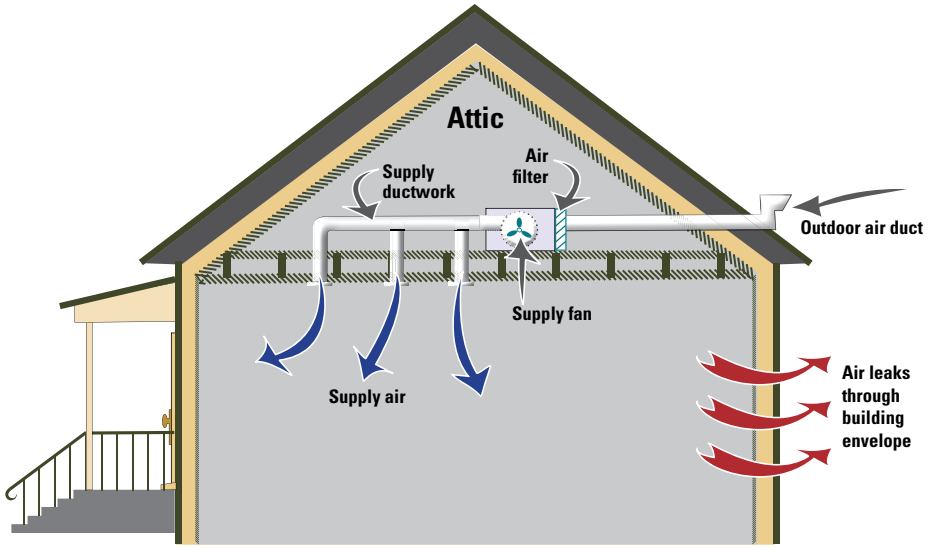

Figure 5. *Supply Ventilation Example*

Ventilation Systems

Trigger Table

Requirement Type	Whole-building Systems		Local Exhaust			
	Mandatory		Mandatory			
For details, click a requirement title or code section → **↓ Project Scope: Change this and nothing else**	**HERS-verified Whole-building IAQ** §150.0(o) §150.2(a)2C	**Air Filter** §150.0(m)12	**Kitchen Local Exhaust** §150.0(o)	**Bathroom Local Exhaust** §150.0(o)	**Clothes Dryer Local Exhaust** §150.0(o)	**HERS-verified Kitchen Hood** §150.0(o)
Remodeling a bathroom	No	No	No	**YES**	No	No
Remodeling a kitchen and adding a kitchen hood	No	No	**YES**	No	No	**YES**
Adding a new dwelling unit that is considered an Addition or new residential building (a detached New Construction habitable building) in an existing home, such as a new accessory dwelling unit (ADU)	**YES** Unless a junior ADU	**YES**	**YES**	**YES**	If applicable	If applicable
Addition to a home > 1,000 ft²	**YES**	If applicable	If applicable	If applicable	If applicable	If applicable
Addition to a home ≤ 1,000 ft²	No	If applicable	If applicable	If applicable	If applicable	If applicable

Table 9. *Energy Code Triggers for Ventilation System Additions and Alterations in Single-family Buildings*

Whole-building Systems

HERS-verified Whole-building Indoor Air Quality

§§150.0(o), 150.2(a)2C

Mandatory Requirements

Commonly Applicable Project Scopes

Airflow for the whole dwelling unit must be verified to meet the requirements of §150.0(o)1C by a HERS Rater when:

- An accessory dwelling unit (ADU) that is considered an Addition or new residential building (a detached New Construction habitable building) is added to the site.
- An Addition to an existing home is > 1,000 ft².

Non-applicable Projects and Exceptions

Additions ≤ 1,000 ft² are not required to provide indoor air quality (IAQ) systems. An ADU created from existing conditioned space (not an Addition or New Construction) is not subject to the IAQ requirements. Altered or replacement IAQ systems that were not required to meet Energy Code IAQ requirements in previous permitted work to the home are not subject to the 2022 Energy Code IAQ requirements.

Requirements

All applicable dwelling units must meet the requirements of ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings as amended in §150.0(o)1. The installing contractor is required to test and document everything installed on an installation certificate. For a list of recommended HVAC testing equipment and supplies, refer to Table 14.

Following the procedures in Reference Residential Appendix RA3.7, a HERS Rater must verify that the airflow meets Energy Code requirements by measuring airflow using a flow hood, flow grid or other airflow measuring device at the mechanical ventilation fan's inlet terminals/grilles or outlet terminals/grilles. Balanced mechanical ventilation system airflow is the average of the supply fan and exhaust fan flows.

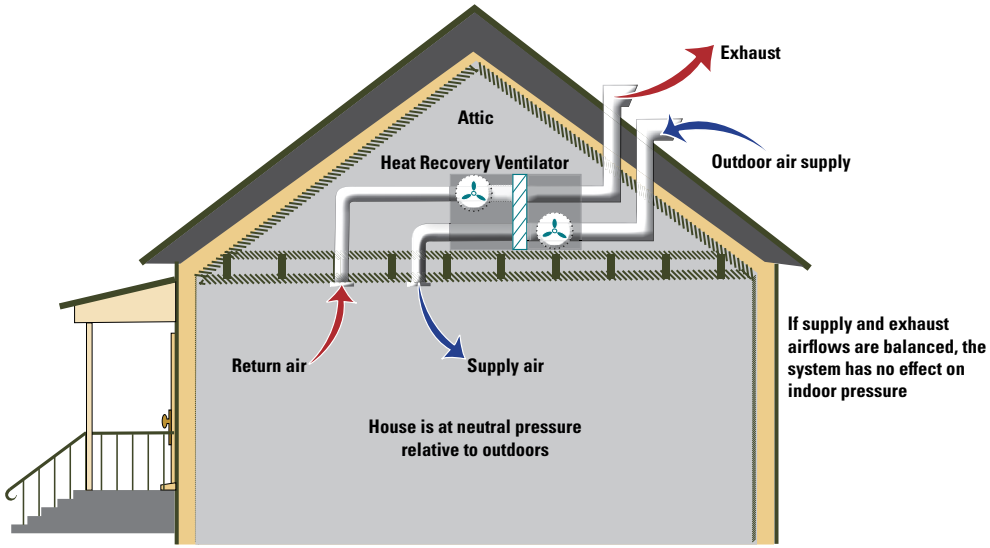

Figure 6. *Balanced Ventilation Example 1 - Heat Recovery Ventilation (HRV) or Energy Recovery Ventilation (ERV)*

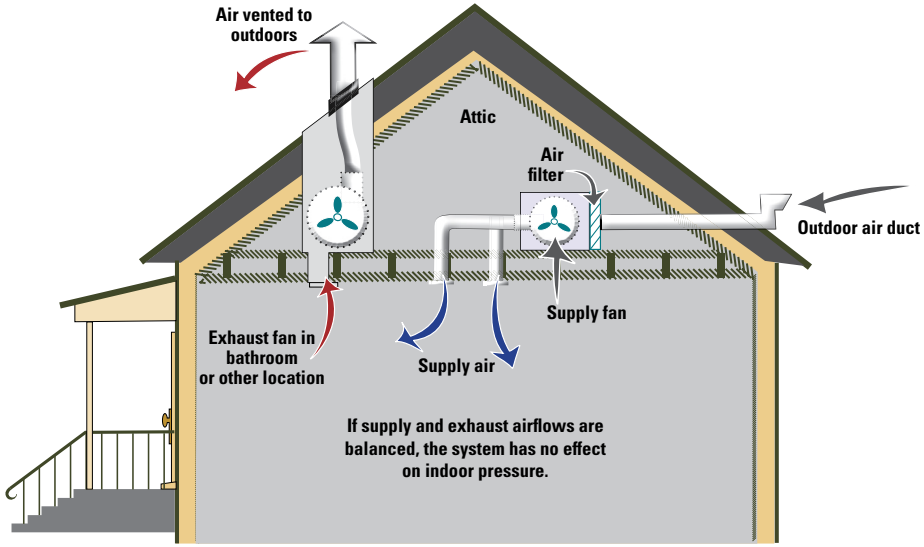

Figure 7. *Balanced Ventilation Example 2 - Separate Supply and Exhaust Fan*

Local Exhaust Systems

Local Exhaust

§150.0(o)

Mandatory Requirements

Commonly Applicable Project Scopes

Energy Code requirements for local exhaust are triggered in the following project scopes in Table 10.

Change this (and nothing else)	Kitchen Local Exhaust	Bathroom Local Exhaust	Clothes Dryer Local Exhaust
Remodeling a bathroom		**YES**	
Remodeling a kitchen and adding a kitchen [range] hood	**YES**		
Adding a dwelling unit to an existing home or property (i.e., ADU)	**YES**	**YES**	If applicable

Table 10. *Local Exhaust Requirements by Project Scope in Single-family Buildings*

Non-applicable Projects and Exceptions

Altered or replacement kitchen hoods or local kitchen exhaust systems that were not required to meet Energy Code kitchen hood and exhaust requirements in previous permitted work to the home are not subject to the 2022 Energy Code kitchen hood and exhaust requirements.

Requirements

Demand-controlled exhaust fans must meet the requirements for airflow rates and capture efficiency in Table 11.

Continuous local ventilation systems must meet the requirements for airflow rates in Table 12.

Dwelling Unit Space	Compliance Criteria
Enclosed Kitchen	Non-range hood kitchen exhaust fans, including downdraft: 300 CFM (150 L/s) or a capacity of 5 ACH
Nonenclosed Kitchen	Non-range hood kitchen exhaust fans, including downdraft: 300 CFM (150 L/s)
Bathroom	50 CFM (25 L/s)
Excerpt from Table 150.0-E Demand-Controlled Local Ventilation Exhaust Airflow Rates and Capture Efficiency	

Table 11. *Demand-controlled Local Ventilation Exhaust Airflow Rates and Capture Efficiency*

Dwelling Unit Space	Compliance Criteria
Enclosed Kitchen	**5 ACH, based on kitchen volume**
Nonenclosed Kitchen	**Not specified**
Bathroom	**20 CFM (10 L/s)**
Excerpt from Table 150.0-F Continuous Local Ventilation Exhaust Airflow Rates	

Table 12. *Continuous Local Ventilation Exhaust Airflow Rates*

HERS-verified Kitchen Range Hood

§150.0(o)

Mandatory Requirements

Commonly Applicable Project Scopes

Energy Code requirements are triggered when a kitchen range hood is added. For the kitchen hood airflow and capture efficiency requirements, see Table 13.

Check the Local Exhaust subtopic above to see whether your project's scope triggers any local exhaust requirements for other fans in the kitchen and dwelling unit.

Non-applicable Projects and Exceptions

See the Local Exhaust subtopic above.

Requirements

The contractor must install a kitchen range hood with an HVI or AHAM listing that shows that the unit can move 100 CFM while not making more than 3 sones of noise. Kitchen range hood fans must meet the ratings for airflow rates and capture efficiency in Table 13.

Dwelling Unit Floor Area (ft^2)	Hood over Electric Range	Hood over Natural Gas Range
> 1,500	50% CE or 110 CFM	70% CE or 180 CFM
> 1,000-1,500	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

Excerpt from 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

Table 13. *Kitchen Range Hood Airflow Rates (CFM) and Capture Efficiency (CE) Ratings*

Required Testing Equipment for Installers

HVAC Testing Equipment	Requirements	Other Equipment and Supplies
Digital refrigerant gauge	± 7.0 psi liquid line pressure ± 3.5 psi suction pressure	**Data Collection Tools** ✦ Digital camera ✦ Data collection sheet or tool ✦ HERS register credentials ✦ PC, tablet or phone ✦ Body-worn camera **Consumables** ✦ Masking tape ✦ Register seal ✦ Approved mastic ✦ UL 181 tape **Standard Field Equipment** ✦ Ladder ✦ Flashlight and head lamp ✦ Radios or walkie talkies ✦ Drop cloth ✦ Drill with 5/8" bit (to drill measurement access holes) ✦ Black marker or pre-printed labels for air filter, MAH holes, etc. **Personal Protective Equipment** ✦ Dust mask ✦ Safety glasses ✦ Gloves ✦ Bump hat ✦ Hard hat ✦ Carbon monoxide monitor ✦ Combustible gas detector
Digital thermometer	Wet bulb ◊ ± 2°F Accuracy ◊ 0.2°F Resolution Dry bulb ◊ ± 2°F Accuracy ◊ 0.2°F Resolution	
Thermocouple (to measure refrigerant line pipe temperature)	± 2°F Accuracy 0.2°F Resolution	
Thermistors-K-couple or RMS		
Duct blaster	± 3 percent of reading or ± 1 CFM (whichever is greater)	
Manometer	± 1% or ± 0.2 Pa. (0.0008 inches water) (whichever is greater)	
Fog machine		
Flow hood	Accuracy of ± 7% of reading or ± 5 CFM (whichever is greater)	
Flow grids		
Blower door		
Static pressure probe		
Portable watt meter (plug in)	Accuracy of ± 2% of reading or ± 10 watts (whichever is greater)	
Portable watt meter (clamp on)	Accuracy of ± 2% of reading or ± 10 watts (whichever is greater)	
Refrigerant scale		
Vacuum pump		
Vacuum gauge		
Recovery bottle		
Tape measure	Actual tape measure, not measuring tape	

Table 14. *HVAC Testing Equipment Needed*

Forms for Single-family Building HVAC Additions and Alterations

In addition to permits, HVAC Additions and Alterations in single-family homes require the following forms, called certificates, for compliance, installation and HERS verification, if that is required. The forms are available on the Energy Code Ace Get Forms landing page: https://www.energycodeace.com/content/get-forms.

1. To determine if your project has any HERS verification requirements, complete and register the appropriate CF1R form.

   The Energy Code Ace Forms Ace™ tool will also help to determine which forms are required.

2. When you complete the Certificate of Compliance for your project, it will inform you which Certificates of Installation and Verification are required.
3. To register your CF1R and other forms and find a HERS Rater, use one of the HERS Providers.

Many building departments require the contractor to register projects that have no HERS verification with a HERS Provider in order to have a registered document stating that the project is exempt from HERS verification.

HERS Providers and Raters

To find a HERS Rater, contact one of the HERS Providers shown below. Each Provider is approved to perform specific services. **Check the CEC website to see if new providers have been approved bit.ly/CEC-HERS-Providers**.

CalCERTS

www.calcerts.com/

Approved for field verification on:

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

CHEERS

www.cheers.org/

Approved for field verification on:

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

HERS Requirements	Project Type	Certificates of Compliance These forms must be completed and signed by the installing contractor.	Certificates of Installation These forms must be completed and signed by the installing contractor and made available for the building department's final inspection.	Certificates of Verification These forms must be completed by the HERS Rater and made available for the building department's final inspection.
No HERS Verifications Required	**Additions**	**CF1R-ADD-02-E**	**CF2R-ADD-02-E**	Not applicable
	Alterations	**CF1R-ALT-05-E**	**CF2R-ALT-05-E**	
HERS Verifications Required	**Additions**	**CF1R-ADD-01-E** This form must be registered with a HERS Provider prior to permit application.	**CF2R-MCH-##-H** These forms must be registered with a HERS Provider prior to final inspection. See the completed CF1R form for the required installation certificates based on the project	**CF3R-MCH-##-H** These forms must be registered with a HERS Provider prior to final inspection. See the completed CF1R form for the required installation certificates based on the project.
	Alterations	**CF1R-ALT-01-E** This form must be registered with a HERS Provider prior to permit application.		

Table 15. *Required Forms for HVAC Additions and Alterations Using the Prescriptive Method in Single-family Buildings*