



Residential
HVAC System Alterations*

Use this checklist when the project is for an **existing** building and either:

- Involves an **entirely new** or complete replacement HVAC system (indoor/outdoor units **and** ≥75% of ducting; for either packaged or split-system)
- Replaces just **part** of an HVAC system (ducts, furnace, air handler, heat exchanger, condensing unit or any refrigerant-containing component)

* This checklist is not intended to support projects in which the enforcement agency requires building design plans and specifications to be submitted with the application for a building permit.

ESSENTIALS

1. Does the project trigger California’s Building Energy Efficiency Standards (Title 24, Part 6)?

YES NO

- The project triggers Title 24, Part 6 (the Energy Code) if it replaces or adds to the existing HVAC system.
- Exceptions that do NOT trigger Energy Code include:
 - Adding ≤ 40 ft of ducting anywhere in home (except for garage). This ducting is not associated with an Addition and uses minimum R-6 insulation in unconditioned spaces.
 - Fixing or changing anything not included in the table below, including anything that is a “refrigerant-containing device.” (For example, fixing or replacing fans, motors, belts and electrical components will NOT trigger the Energy Code)

2. Does it meet the Energy Code’s Requirements under the Prescriptive Approach?

YES NO

If project changes this – and nothing else...	Mandatory Requirements							Prescriptive Requirements	
	Equipment Efficiency ^A	Thermostat (Setback or EMCS) ^B	Cooling & Heating Loads ^C	Air Filter 2” MERV-13 ^D	HERS: Duct Leakage ^E	HERS: Airflow Rate ^F	HERS: Fan Efficacy ^F	Duct Insulation ^G	HERS: Refrigerant Charge ^H
• New HVAC and ≥ 75% New Ducts	yes	yes	yes	yes	yes	yes if AC	yes if AC	yes	yes if AC
• Add ≤ 40 ft ducting to existing HVAC	no	no	yes if Addition	no	no	no	no	yes	no
• Add/replace AC to ducted system	yes	yes	no	no	yes	yes	no	no	yes if AC
• Replace furnace only	yes	no	no	no	yes	no	no	no	no
• Replace room heating/AC unit using existing fuel type	yes	no	no	no	no	no	no	no	no
• Replace < 75% ducting only	no	no	no	no	yes	no	no	yes	no
• Replace ≥ 75% ducting only ^I	no	no	no	yes	yes	yes if AC	yes if AC	yes	no
• Replace heating and cooling equipment only (no altered ducting)	yes	yes if AC	no	no	yes if ducted	yes if AC	no	no	yes if AC
• Replace gas with electric heat pump	yes	yes	no	no	yes if ducted	no	no	no	yes if AC
• Replace gas with electric resistance	Not allowed per §150.2(b)G								

3. Are the necessary Prescriptive forms included with the permit application?

YES NO

If the project...	Include this form:
Involves a ducted system, or adds/replaces AC, in an existing building	CF1R-ALT-02-E: Certificate of Compliance for Alterations (with HERS)**
Involves a non-ducted system and does NOT add/replace AC in an existing building	CF1R-ALT-05-E: Certificate of Compliance for Residential Alterations (Non-HERS)

Note: If the project involves an Addition onto a home along with an HVAC Alteration, alternative CF1R-ADD paperwork will be required.

** This is an electronic form that **must** be registered with a HERS Provider prior to permit application. It can be used with any climate zone.

A – I See page 3 for notes.

HVAC Permits, HERS Measures & Required Documentation

The permit applicant wants to change to a different fuel source for the new HVAC system. Can a permit be granted?

- Per Section 150.2(b)1Cii of the Energy Code, the fuel source of the new system can only be natural gas, liquefied petroleum gas or the existing HVAC system fuel type. If the fuel type of the prior system was gas, the replacement space-conditioning system may be a heat pump.

Are Certificates of Compliance (CF1R forms) really required for an altered HVAC system?

- As with any project involving Home Energy Rating System (HERS) verification, as soon as one HERS measure is triggered, **all** forms must then be registered with a HERS Provider. This applies whether or not a given project form directly involves a HERS measure.
- With the exception of projects only adding 40 ft or less of ducts to an existing HVAC system, **all ducted** HVAC unit replacements will trigger HERS verification. However, there are other types of HVAC system replacements that will not trigger HERS, such as wall furnaces, gas space heaters and room air conditioners.
 - Some enforcement agencies may, at their discretion, choose **not** to require compliance documents for Prescriptive Residential Alteration projects that do NOT require Home Energy Rating System (HERS) verification. Even so, exemptions from submitting compliance documentation shall not be deemed to grant authorization for any work to be done in any manner in violation of this code or other provisions of law. See §10-103(a)1C for more information.

What forms will the building inspector require?

- In addition to the CF1R-ALT form submitted with the permit application, the inspector will look for the CF2R-MCH-01-E: Certificate of Installation for Space Conditioning Systems, Ducts & Fans, which is completed by the installing contractor.
- Additional forms required by the building inspector depend on project scope and associated HERS measures which is provided by the Project Status Report (provided by the HERS Providers). The most commonly used CF2R (Certificates of Installation) and CF3R (Certificates of Verification) forms for HVAC projects are:

Responsibility of Installing Contractor:

- CF2R-MCH-20-H:** Duct Leakage Diagnostic Test
- CF2R-MCH-22-H:** Space Conditioning System Fan Efficacy
- CF2R-MCH-23-H:** Space Conditioning System Airflow Rate
- CF2R-MCH-25-H:** Refrigerant Charge Verification

Responsibility of HERS Rater:

- CF3R-MCH-20-H:** Duct Leakage Diagnostic Test
- CF3R-MCH-22-H:** Space Conditioning System Fan Efficacy
- CF3R-MCH-23-H:** Space Conditioning System Airflow Rate
- CF3R-MCH-25-H:** Refrigerant Charge Verification

Prescriptive or Performance

What do you mean by “Performance Approach” to compliance?

- The Performance Approach uses approved modeling software to “trade off” energy efficiency measures (so you can do “worse” than Prescriptive for some things, and “better” than Prescriptive for others, as long as the Mandatory requirements are met and the energy budget balances). This proof of energy budget balance is documented via the CF1R-PRF-01-E report. This may be considered if the project is unable to meet the Prescriptive requirements for an HVAC Alteration supported by this checklist.

Confirming Equipment Compliance with Federal and State Regulations

What resources can I direct permit applicants to in order to find out whether a particular make and model of HVAC system is compliant with Mandatory Federal and State Appliance Efficiency regulations?

- All appliances regulated under Title 20 must be certified to the California Energy Commission via its MAEDbS™ database (Modernized Appliance Efficiency Database System). The general public can access this database directly at: <https://cacertappliances.energy.ca.gov/>

Notes

- A** §110.1 & 110.2(a): All HVAC equipment must be certified through Title 20 Appliance Efficiency Standards and meet minimum efficiency requirements. For more on these requirements, see Energy Code Ace's Quick Reference sheet entitled "2019 Residential Heating & Cooling Equipment Minimum Efficiencies," found here: energycodeace.com/download/35781/file_path/fieldList/QR.ResMinHeatCoolEfficiencies.2019
- B** §110.2(c), 150.0(i) & 150.2(b)1F: Setback thermostat shall have a clock mechanism that allows the building occupant to program the temperature setpoints for at least four periods within 24 hours. 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.
- C** Per Residential Building Code §303.10 and Building Code §1204.1: Heating systems shall maintain a room temperature of $\geq 68^{\circ}\text{F}$, which is typically confirmed via heating load calculations.
- D** §150.0(m)12-13 & 150.2(b)1C-D: Air filters to be 2" MERV-13 when Alteration project involves entirely new/complete replacement HVAC system (equipment and ducts), or replacing $\geq 75\%$ of the ducting, and has > 10 ft of ducting. Alternative filter size options may apply.
- E** §150.2(b)1C, D & E: HERS duct testing is not required when asbestos is present. New/replacement space-conditioning ducts, plenums, air handling units, and cooling or heating coils located in a garage space shall meet minimum leakage requirement and/or be visually inspected by a HERS Rater.
- F** §150.0(m)13 & 150.2(b)1C-F: HERS Airflow Rate and HERS Fan Efficacy apply to new or completely replaced space-conditioning systems that use forced air ducts to supply cooling to an occupiable space (does not apply to heating only systems, or to non-ducted cooling systems).
- Pipe Insulation: Sections 150.0(j)2B, 150.0(j)2-3 and 120.3, as well as Table 120.3-A: Cooling system suction lines $\leq 1.5"$ in diameter must have a minimum of 0.75" thick insulation for any newly installed air conditioner systems.
- G** §150.0(m)1, 150.1(c)9 & 150.2(b)1D: Duct insulation requirements for Climate Zone 10:
- Altered duct system (<75% New Ducts) in conditioned & unconditioned spaces: Min. R-6 duct insulation
 - New duct ($\geq 75\%$ New Ducts) in conditioned & unconditioned spaces: Min. R-6 duct insulation
 - An HVAC system is considered to have "all new" ducts when 75% or more of the ducts are new material. Up to 25% of existing duct system components (such as registers, grilles, boots, air handler, coil, plenums and duct material) may be reused if those parts are accessible and can be sealed to prevent leakage.
- H** §150.1(c)7A & 150.2(b)1F: HERS Refrigerant Charge verification is Prescriptively required in Climate Zone 10 when refrigerant-containing components such as the compressor, condensing coil, evaporator coil, refrigerant metering device or refrigerant piping are altered or added.
- I** Entirely new or complete replacement duct systems installed as part of an Alteration shall be constructed of at least 75 percent new duct material, and up to 25 percent may consist of reused parts from the dwelling unit's existing duct system including but not limited to registers, grilles, boots, air handler, coil, plenums, duct material; if the reused parts are accessible and can be sealed to prevent leakage.

For More Information

The Energy Code (Title 24, Part 6 Energy Standards)

- Energy Code Section **150.2(b)1C** – Energy Efficiency Standards for Alterations to Existing Low-rise Residential Buildings – Prescriptive Approach, **Entirely New or Complete Replacement Space-Conditioning Systems**
energycodeace.com/site/custom/public/reference-ace-2019/index.html#!Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm
- Energy Code Section **150.2(b)1D** – Energy Efficiency Standards for Alterations to Existing Low-rise Residential Buildings – Prescriptive Approach, **Altered Duct Systems – Duct Sealing**
energycodeace.com/site/custom/public/reference-ace-2019/index.html#!Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm
- Energy Code Section **150.2(b)1E,F,G** – Energy Efficiency Standards for Alterations to Existing Low-rise Residential Buildings – Prescriptive Approach, **Altered Space-Conditioning System – Duct Sealing (E), Mechanical Cooling (F), Altered Space-Conditioning System (G)**
energycodeace.com/site/custom/public/reference-ace-2019/index.html#!Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm
- Energy Code **Table 150.2-A** – **Duct Insulation R-value**
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm#table1502aductinsulationrvalue.htm
- Energy Code Section **110.2** – **Mandatory Requirements** for Space Conditioning Equipment
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1102mandatoryrequirementsforspaceconditioningequipment.htm
- Energy Code Sections **150.0(h),(i),(j)2-3,(m)1-13** – **Mandatory Requirements** for Space Conditioning Equipment (h), Thermostats (i), Water System Piping and Insulation for Piping, Tanks, and Cooling System Lines (j), and Air-Distribution and Ventilation System Ducts, Plenums, and Fans (m)
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1500mandatoryfeaturesanddevices.htm

To Interpret the Energy Code

- Energy Code Ace **Fact Sheet: Residential HVAC Alterations**
energycodeace.com/download/35120/file_path/fieldList/FactSheet.Res-HVAC-Alts.2019
- Energy Code Ace **Fact Sheet: Just the Basics: HERS**
energycodeace.com/download/35128/file_path/fieldList/FactSheet.Res.NR.HERS.2019
- Energy Code Ace **Trigger Sheet: Residential HVAC Alterations**
energycodeace.com/download/35089/file_path/fieldList/TriggerSheet.Res-HVAC-Alts.2019
- Energy Code Ace **Quick Reference: Residential Heating & Cooling Equipment Minimum Efficiencies**
energycodeace.com/download/35781/file_path/fieldList/QR.ResMinHeatCoolEfficiencies.2019
- Energy Code Ace **Application Guide: Residential HVAC and Plumbing** (see Chapter 5)
energycodeace.com/download/36880/file_path/fieldList/AppGuide.Res.%20HVAC_Plumbing.2019
- Energy Code **Residential Compliance Manual** (see Chapter 4: Building HVAC Requirements)
energycodeace.com/site/custom/public/reference-ace-2019/Documents/4buildinghvacrequirements.htm

Forms for HVAC Alteration Projects (Prescriptive Approach)

This depends on the scope of work. The most commonly used CF2R and CF3R forms for HVAC projects are shown below.

- **CF1R-ALT-02-E: Certificate of Compliance** for Residential Alterations to Space Conditioning Systems (with HERS)
efiling.energy.ca.gov/GetDocument.aspx?tn=232774-4&DocumentContentId=64851
- **CF1R-ALT-05-E: Certificate of Compliance** for Prescriptive Residential Alterations (Non-HERS)
efiling.energy.ca.gov/GetDocument.aspx?tn=232774-5&DocumentContentId=64852
- **CF2R-MCH-01b*-E: Certificate of Installation** for Space Conditioning Systems, Ducts & Fans (for Prescriptive Alterations)
efiling.energy.ca.gov/GetDocument.aspx?tn=232776-18&DocumentContentId=64979
- **CF2R-MCH-20*-H: Certificate of Installation** for Duct Leakage Diagnostic Test
efiling.energy.ca.gov/GetDocument.aspx?tn=232777-10&DocumentContentId=65007
- **CF2R-MCH-22*-H: Certificate of Installation** for Space Conditioning System Fan Efficacy
efiling.energy.ca.gov/GetDocument.aspx?tn=232777-7&DocumentContentId=65010
- **CF2R-MCH-23*-H: Certificate of Installation** for Space Conditioning System Airflow Rate
efiling.energy.ca.gov/GetDocument.aspx?tn=232777-3&DocumentContentId=65014
- **CF2R-MCH-25*-H: Certificate of Installation** for Refrigerant Charge Verification (for use in Climate Zone 10)
efiling.energy.ca.gov/GetDocument.aspx?tn=232777-15&DocumentContentId=65002
- **CF3R-MCH-20*-H: Certificate of Verification** for Duct Leakage Diagnostic Test
efiling.energy.ca.gov/GetDocument.aspx?tn=232779-25&DocumentContentId=65066
- **CF3R-MCH-22*-H: Certificate of Verification** for Space Conditioning System Fan Efficacy
efiling.energy.ca.gov/GetDocument.aspx?tn=232779-22&DocumentContentId=65069
- **CF3R-MCH-23*-H: Certificate of Verification** for Space Conditioning System Airflow Rate
efiling.energy.ca.gov/GetDocument.aspx?tn=232779-18&DocumentContentId=65073
- **CF3R-MCH-25*-H: Certificate of Verification** for Refrigerant Charge Verification (for use in Climate Zone 10)
efiling.energy.ca.gov/GetDocument.aspx?tn=232779-10&DocumentContentId=65081

* Correct version (e.g., "a", "b", "c") varies depending upon the project scope and approach used to demonstrate compliance. A complete list of forms by project scope can be found here on the California Energy Commission's website: efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=18-BSTD-02



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