

What is a Residential HVAC Alteration?

A residential HVAC alteration is any change to a home's space-conditioning system that is regulated by the 2019 California's Building Energy Efficiency Standards (Energy Code), Title 24, Part 6 which include systems that provide heating or cooling within or associated with conditioned spaces in a home. Title 24, Part 6 includes requirements for alterations affecting residential space-conditioning systems, which are generally categorized in the following three groups:

- Altered or Replaced Duct Systems
- Altered Space-Conditioning System
- Entirely New or Complete Replacement Space-Conditioning System

Why?

As much as half of the energy used in a typical home goes to heating and cooling. Ensuring that HVAC systems are as efficient as possible can result in significant energy savings.

Relevant Code Sections

2019 California Building Energy Efficiency Standards, Title 24, Part 6:

- [Section 110.2](#) – Mandatory Requirements for Space-Conditioning Equipment
- [Section 150.0](#) – Mandatory Features and Devices
 - 150.0(h) – Space-Conditioning Equipment
 - 150.0(i) – Thermostats
 - 150.0(m) – Air-Distribution and Ventilation System Ducts, Plenums, and Fans
 - 150.0(j) – Suction Line Insulation
- [Section 150.1](#) – Performance and Prescriptive Compliance Approaches for Newly Constructed Residential Buildings
- [Section 150.2](#) – Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings
 - 150.2(b)1C – New or Complete Replacement Space - Conditioning System
 - 150.2(b)1D – Altered Duct Systems - Duct Sealing
 - 150.2(b)1E – Altered Space-Conditioning System - Duct Sealing
 - 150.2(b)1F – Altered Space-Conditioning System - Mechanical Cooling
 - 150.2(b)1G – Water-Heating System
- [Residential Compliance Manual, Chapter 4](#) – HVAC Building Requirements

What is an Altered Duct System?

- Extension of Existing Ducts
 - >40 ft of extended duct system
 - any altered ducts in garage spaces
- Entirely New or Replacement Ducts
 - ≥75% of new duct system
 - Up to 25% existing duct system components may be reused, if accessible and can be sealed

Note: ≤40 ft of altered or extended duct does not trigger compliance documentation or duct leakage testing, unless it is in the garage. If ≤40 ft and not in garage, it must meet mandatory R-6 insulation only.

Table 150.2-A Duct Insulation R-Value

Climate Zone	1 through 10, 12 & 13	11, 14 through 16
Duct R-Value	R-6	R-8

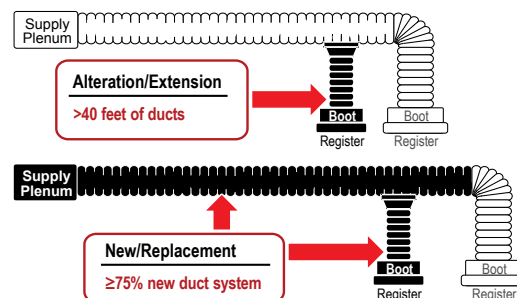


Figure 1: Altered or Replaced Duct Systems (Duct Sealing): §150.2(b)1D

What is an Altered Space-Conditioning System?

If the alteration is not a complete replacement of the space conditioning system but one or more of the following components is installed or replaced, it is considered an Altered Space-Conditioning System.

- Any refrigerant-containing component, including:
 - Cooling coil
 - Condenser coil
 - Compressor Refrigerant piping
 - Refrigerant metering device
 - Outdoor condensing unit

OR

- Air handler

Acceptable fuel types for replacement space-conditioning systems include:

- Natural gas
- Liquefied petroleum gas
- The fuel type of the system being replaced

If the fuel type of the system being replaced is gas, the replacement space-conditioning system may be a heat pump.

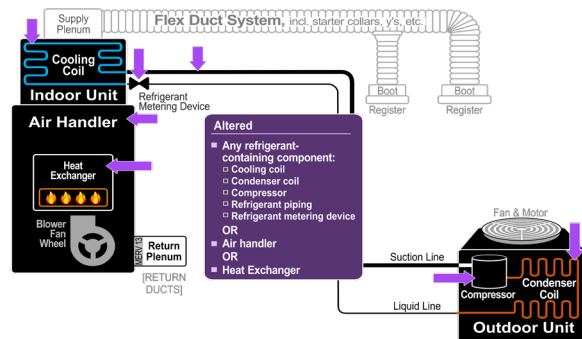


Figure 2: Altered Space-Conditioning System: §150.2(b)1E,F

Replacing other components is considered a repair - not an alteration. For example, replacing the blower wheel fan, but not the heat exchanger or air handler in the furnace, is a repair. Repairs do not trigger Title 24, Part 6 code requirements.

What is Entirely New versus Complete Replacement of a Space-Conditioning System?

When all of the following are installed or replaced:

- All the system heating/cooling components
- >75% new duct material

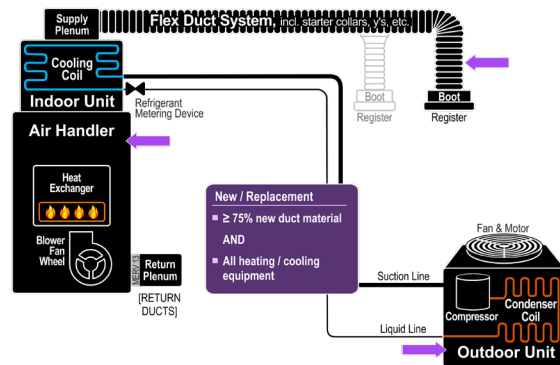


Figure 3: Entirely New or Complete Replacement Space-Conditioning System: §150.2(b)1C

Setback Thermostats: §110.2

Only altered or new/replacement cooling systems trigger installation of setback thermostat. It is not required for heating-system-only replacements, unless the entire heating system including ducts is replaced, per Sections 150.0(i) and 150.2(b)C.

Equipment Efficiency: §110.2

Most heating and cooling equipment installed in California homes is regulated by the National Appliance Efficiency Conservation Act (NAECA) and/or the California Appliance Efficiency Regulations (Title 20).

Duct Sealing and Testing (HERS measure)

Duct Sealing and Testing (HERS measure) is required for both altered duct systems and new/replacement duct systems.

- **Extension of Existing Ducts >40 ft:** The measured leakage must be ≤15% of system air handler air flow. (There are alternatives to meeting the maximum 15% leakage. Consult your Building Department or Section 150.2(b)1Diib).
- **Altered Space Conditioning System:** The measured leakage must be ≤15% of system air handler air flow. (There are alternatives to meeting the maximum 15% leakage. Consult your Building Department or Section 150.2(b)1E). In addition, the system must have a cooling coil airflow >300 CFM per ton of nominal cooling capacity or >250 CFM per ton of nominal cooling capacity for small duct high velocity systems and verified by the HERS Rater. Refrigerant Charge verification is Prescriptively required for Climate Zones 2 and 8-15.
- **New/Replacement Space Conditioning System:** The Duct Sealing and Testing (HERS measure) must demonstrate a leakage rate ≤5% of the system air handler airflow. In addition, verification of Cooling Coil Airflow and Fan Watt Draw (HERS measure) is required. Refrigerant Charge verification is Prescriptively required for Climate Zones 2 and 8-15.
- **Altered Ducts in Garage Spaces:** The measured leakage must be ≤6% of system air handler air flow. If measured leakage is not possible an alternative would be to have all accessible leaks sealed and verified through visual inspection and smoke tested by a certified HERS Rater.

Forms: Which & When

In addition to a permit, typically HVAC alterations require the following:

- **CF1R: Certificate of Compliance: Alteration to an HVAC System**
 - **CF1R-ALT-02-E**
 - Completed and signed by the installing contractor
 - Must be registered with a HERS Provider prior to permit application
- **CF2R-MCH-01 (Tables a-e): Certificate of Installation for Space Conditioning Systems, Ducts and Fans**
 - Completed and signed by the installing contractor, and made available for final inspection by building department
 - Must be registered with a HERS Provider prior to final inspection
- **CF3R-MCH Forms: Certificate of Verification**
 - **CF3R-MCH-20*-H: Certificate of Verification for Duct Leakage Diagnostic Test**
 - Completed by the HERS rater and made available for final inspection by building department
 - Must be registered with a HERS Provider prior to final inspection
 - **CF3R-MCH-22*-H: Certificate of Verification for Fan Efficacy**
 - Completed by the HERS rater and made available for final inspection by building department
 - Must be registered with a HERS Provider prior to final inspection
 - **CF3R-MCH-23*-H: Certificate of Verification for Airflow Rate**
 - Completed by the HERS rater and made available for final inspection by building department
 - Must be registered with a HERS Provider prior to final inspection
 - **CF3R-MCH-25*-H: Certificate of Verification Refrigerant Charge**
 - Completed by the HERS rater and made available for final inspection by building department
 - Must be registered with a HERS Provider prior to final inspection

* Correct version (e.g., "a," "b" and "c") varies depending upon the project scope and approach used to demonstrate compliance

ALTERATIONS TO SPACE CONDITIONING SYSTEMS
CERTIFICATE OF COMPLIANCE
 Alterations to Space Conditioning Systems

A. General Information
 01 Project Name
 02 Date Prepared
 03 Project Location
 04 Building Type
 05 City
 06 Ducting (Yes/No)
 07 ZIP Code
 08 Ducting (Yes/No)
 09 Owner Name
 10 Number of Space Conditioning (SC) Systems in this building unit

B. Space Conditioning (SC) System Information
 01 SC System Description (e.g., Furnace, Heat Pump, etc.)
 02 SC System Capacity (BTU/hr)
 03 Heating & Cooling (Yes/No)
 04 Heating & Cooling (Yes/No)
 05 Heating & Cooling (Yes/No)
 06 Heating & Cooling (Yes/No)
 07 Heating & Cooling (Yes/No)
 08 Heating & Cooling (Yes/No)
 09 Heating & Cooling (Yes/No)
 10 Alteration Type

C. Extension of Existing Duct System, Greater Than 40 Feet (Section 100.2.2.10.1)
 01 SC System Description (e.g., Furnace, Heat Pump, etc.)
 02 SC System Capacity (BTU/hr)
 03 Heating & Cooling (Yes/No)
 04 Heating & Cooling (Yes/No)
 05 Heating & Cooling (Yes/No)
 06 Heating & Cooling (Yes/No)
 07 Heating & Cooling (Yes/No)
 08 Heating & Cooling (Yes/No)
 09 Heating & Cooling (Yes/No)
 10 Alteration Type

Registration Number: CA Building Energy Efficiency Standards - 2019 Residential Compliance Registration Date/Time: HERS Provider: January 2019

SPACE CONDITIONING SYSTEMS, DUCTS, AND FANS
CERTIFICATE OF INSTALLATION
 Space Conditioning Systems, Ducts and Fans

A. General Information
 01 Ducting Unit Name
 02 Heating Unit Conditional Power Area (HPA)
 03 Certificate of Compliance Type
 04 Calculated Heating Unit Sensible Cooling Load (BTU/h)
 05 Calculated Heating Unit Heating Load (BTU/h)
 06 Ducting Unit Number of Branches

B. Design Space Conditioning (SC) System Component Specifications (per 100.2.1.1)
 This table reports the space conditioning system design that was specified for the building. It is not a permit requirement for this project.

Zone Name	SC System (Thermostat)	SC System Type	Heating System Type	Cooling System Type	Control System Type	Control Fan Reference	Conditioning System Type	Approved Insulation Type	Low Leakage Unit Status	Supply Duct Status	Conditioning Ducting Type	Control System Component Speed Type

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

Registration Number: CA Building Energy Efficiency Standards - 2019 Residential Compliance Registration Date/Time: HERS Provider: January 2019

DUCT LEAKAGE DIAGNOSTIC TEST
CERTIFICATE OF VERIFICATION
 Duct Leakage Diagnostic Test

A. System Information
 01 Space Conditioning System Identification or Name
 02 Space Conditioning System Location in Area Served
 03 Building Type (per 100.2.1.1)
 04 Heating Unit Capacity (BTU/h)
 05 Heating Unit Capacity (BTU/h)
 06 Heating Unit Capacity (BTU/h)
 07 Heating Unit Capacity (BTU/h)
 08 Heating Unit Capacity (BTU/h)
 09 Heating Unit Capacity (BTU/h)
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 23 Heating Unit Capacity (BTU/h)
 24 Heating Unit Capacity (BTU/h)

MCH-01a - Complete New Duct System
 01 Air Handling Unit (AHU) or Fan Coil Unit (FCU) Identification Number
 02 Conditioner Pressure Control Capacity (BTU/h)
 03 Indoor Air System Control Capacity
 04 Heating Capacity (BTU/h)
 05 Conditioning Unit Name Served by this HVAC System (e.g., Furnace, Heat Pump, etc.)
 06 Duct Leakage Test Method
 07 Duct Leakage Test Results
 08 Leakage Factor
 09 Calculated Fan Leakage (per Leakage Test Table)
 10 Actual Duct Leakage Rate (per Leakage Test Table)
 11 Compliance Level
 12 Notes

Registration Number: CA Building Energy Efficiency Standards - 2019 Residential Compliance Registration Date/Time: HERS Provider: January 2019

For More Information

Primary Sources

- Energy Code Section 110.2 – Mandatory Requirements for Space-Conditioning Equipment
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1102mandatoryrequirementsforspaceconditioningequipment.htm
- Energy Code Section 150.0 – Mandatory Features and Devices
energycodeace.com/site/custom/public/reference-ace-2019/index.html#!Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Code Section 150.1 – Performance and Prescriptive Compliance Approaches for Newly Constructed Residential Buildings
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm
- Energy Code Section 150.2 – Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings
energycodeace.com/site/custom/public/reference-ace-2019/index.html#!Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm
- Energy Code Residential Compliance Manual, Chapter 4 – HVAC Building Requirements
energycodeace.com/site/custom/public/reference-ace-2019/Documents/4buildinghvacrequirements.htm

Compliance Forms

- Residential Compliance Forms
energycodeace.com/ResidentialForms/2019

California Energy Commission Information & Services

- Energy Code Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center
 - The Energy Commission’s main web portal for the Energy Code, including information, documents and historical information

Additional Resources

- Energy Code Ace:
EnergyCodeAce.com
 - An online “one-stop-shop” providing free resources and training to help appliance and building industry professionals decode and comply with Title 24, Part 6 and Title 20. The site is administered by California’s investor-owned utilities.

Of special interest:

Trigger Sheets

energycodeace.com/content/resources-trigger-sheets/

- Residential HVAC Alterations 2019

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