

What is a Residential HVAC Alteration?

A residential HVAC alteration is any change to a home’s space-conditioning system that is regulated by Title 24, Part 6, which include systems that provide heating, or cooling within or associated with conditioned spaces in a home. The 2016 Building Energy Efficiency Standards (Energy Standards) Title 24, Part 6 include 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

Title 24, Part 6 Building Energy Efficiency Standards:

- **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
- **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

Altered or Replaced Duct Systems (Duct Sealing)

- Extension of Existing Ducts
 - >40 ft of extended duct system
- 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. 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

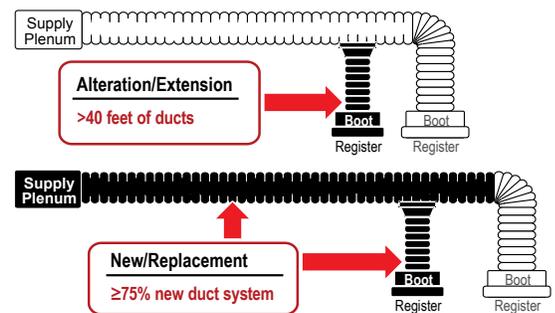


Figure 1: Altered or Replaced Duct Systems (Duct Sealing): §150.2(b)1D

Altered Space-Conditioning System

Not entirely new or complete replacement space-conditioning system and any of the following components is installed or replaced:

- Any refrigerant-containing component, including:
 - Cooling coil
 - Condenser coil
 - Compressor Refrigerant piping
 - Refrigerant metering device
 - Outdoor condensing unit
- OR
- Air handler
- OR
- Heat exchanger

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.

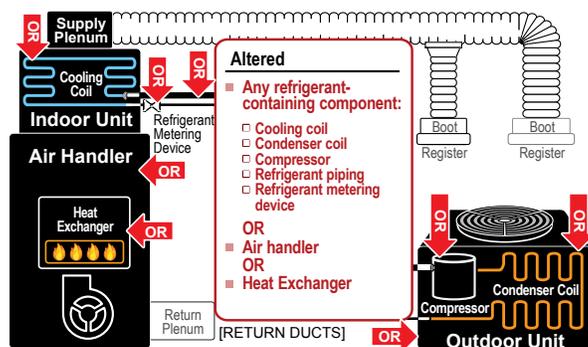


Figure 2: Altered Space-Conditioning System: §150.2(b)1E,F

Entirely New or Complete Replacement Space-Conditioning System

All of the following are installed or replaced:

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

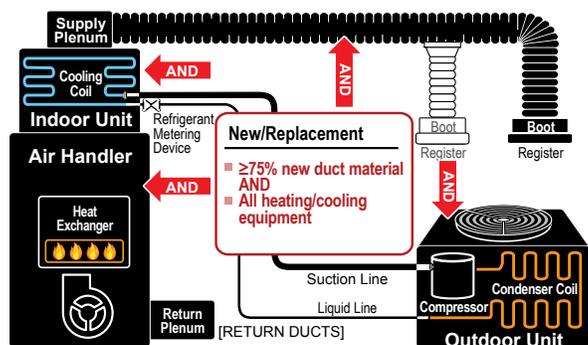


Figure 3: Entirely New or Complete Replacement Space-Conditioning System: §150.2(b)1C

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 $\leq 15\%$ 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 $\leq 15\%$ 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 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 $\leq 5\%$ of the system air handler airflow. In addition, verification of Cooling Coil Airflow and Fan Watt Draw (HERS measure) is required. The system must have cooling coil airflow > 350 CFM per ton of nominal cooling capacity, and an air-handling unit fan efficacy ≤ 0.58 W/CFM. Refrigerant Charge verification is Prescriptively required for Climate Zones 2 and 8-15.

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.

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 \(Title 20\)](#)

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
 - **CF1R-ALT-03-E**
 - For Climate Zones 1, 3-7, 16
 - May be filled out by hand, but must be registered with a HERS Provider prior to final inspection
 - **CF1R-ALT-04-E**
 - For Climate Zones 2, 8-15
 - May be filled out by hand, but must be registered with a HERS Provider prior to final inspection
- **CF2R-MCH-01*-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", "c") varies depending upon the project scope and approach used to demonstrate compliance

ALTERATIONS TO SPACE CONDITIONING SYSTEMS
CERTIFICATE OF COMPLIANCE
 CA Building Energy Efficiency Standards - 2016 Residential Compliance

A. General Information

CF1R-ALT-02-E is applicable to multiple space conditioning systems contained within a single dwelling unit. When multiple dwelling units must be equipped, use form CF1R-ALT-02 document for each dwelling unit.

01 Project Name
 02 Date Prepared
 03 Project Location
 04 Building Type
 05 Project Start Date
 06 Dwelling Unit Number
 07 Dwelling Unit Size (sq ft)
 08 Climate Zone
 09 Number of Space Conditioning (SC) Systems in the Dwelling Unit
 10 HERS Provider

B. Space Conditioning (SC) System Information

SC System Identification	SC System Manufacturer or Model	SC System Capacity or Area Served (sq ft)	CFR-101 is the SC system a ducted system?	Including a refrigerant handling component?	Refrigerant type (if not R-410A or R-32)?	Refrigerant charge (lb) (if not R-410A or R-32)?	Refrigerant handling area (SC system)?	Installation date (MM/YY)	Alteration Type
01	02	03	04	05	06	07	08	09	10

C. Extension of Existing Duct System, Greater Than 40 Feet (Section 150.23.1(a)(2))

01 System Identification or Name
 02 New Duct Installation

Technical Specifications
 CF1R-MCH-01 - Space Conditioning Systems
 MCH-01 includes requirements for duct systems. R2 1.16, 12.4, 13 and R4 (22.1 & 14.4)
 Leakage rate (m³/min) (Eq. 14.1) - The maximum of use of allowable leaks
 Condition: LISTING duct systems certified, checked or sealed with sealants are exempt from MCH-01 duct leakage testing requirements.

Registration Number: CA Building Energy Efficiency Standards - 2016 Residential Compliance
 Registration Date/Time: HERS Provider: March 2016

SPACE CONDITIONING SYSTEMS DUCTS AND FANS
CERTIFICATE OF INSTALLATION
 CA Building Energy Efficiency Standards - 2016 Residential Compliance

A. General Information

01 Dwelling Unit Name
 02 Climate Zone
 03 Dwelling Unit Total Conditioned Floor Area (sq ft)
 04 Number of Space Conditioning Systems in the Dwelling Unit
 05 Location of Compliance Type
 06 Method Used to Calculate HVAC Loads
 07 Calculated Dwelling Unit Sensible Cooling Load (Btu/h)
 08 Calculated Dwelling Unit Heating Load (Btu/h)
 09 Dwelling Unit Number of Bedrooms

B. Space Conditioning (SC) System Component Specifications with CF1R

Zone Name	Space Conditioning System	SC System Capacity or Area Served (sq ft)	Refrigerant Handling Component Type	Refrigerant Type	Refrigerant Charge (lb)	Refrigerant Handling Area (SC system)	Installation Date (MM/YY)	Alteration Type
01	02	03	04	05	06	07	08	09

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

This table reports on space conditioning systems that were installed on this project.

SC System Identification	SC System Manufacturer or Model	SC System Capacity or Area Served (sq ft)	Refrigerant Handling Component Type	Refrigerant Type	Refrigerant Charge (lb)	Refrigerant Handling Area (SC system)	Installation Date (MM/YY)	Alteration Type
01	02	03	04	05	06	07	08	09

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DUCT LEAKAGE DIAGNOSTIC TEST
CERTIFICATE OF VERIFICATION
 CA Building Energy Efficiency Standards - 2016 Residential Compliance

A. System Information

01 Space Conditioning System Identification or Name
 02 Space Conditioning System Location or Area Served
 03 Building Type from CF1R
 04 Method Used to Calculate HVAC Loads
 05 Calculated Dwelling Unit Sensible Cooling Load (Btu/h)
 06 Calculated Dwelling Unit Heating Load (Btu/h)

MCH-20a - Compliance with Duct System

01 Compliant with California Title 24
 02 Compliant with California Title 24
 03 Compliant with California Title 24
 04 Compliant with California Title 24
 05 Compliant with California Title 24
 06 Compliant with California Title 24
 07 Compliant with California Title 24
 08 Compliant with California Title 24
 09 Compliant with California Title 24
 10 Compliant with California Title 24
 11 Compliant with California Title 24
 12 Note:

Registration Number: CA Building Energy Efficiency Standards - 2016 Residential Compliance
 Registration Date/Time: HERS Provider: March 2016

For More Information

Primary Sources

- Energy Standards Section 110.2 – Mandatory Requirements for Space-Conditioning Equipment
energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1102mandatoryrequirementsforspaceconditioningequipment.htm
- Energy Standards Section 150.0 – Mandatory Features and Devices
energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1500mandatoryfeaturesanddevices.htm
- Energy Standards Section 150.1 – Performance and Prescriptive Compliance Approaches for Newly Constructed Residential Buildings
energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1501performanceandprescriptivecomplianceapproachesforlowr.htm
- Energy Standards Section 150.2 – Energy Efficiency Standards for Additions and Alterations to Existing Low-Rise Residential Buildings
energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm
- Residential Compliance Manual, Chapter 4: HVAC Building Requirements
energy.ca.gov/2015publications/CEC-400-2015-032/chapters/chapter_4-Building_HVAC_Requirements.pdf

California Energy Commission Information & Services

- Energy Standards Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
energy.ca.gov/title24/orc/
 - The Energy Commission’s main web portal for Energy Standards, 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:*
 - 2016 Trigger Sheet on Residential HVAC Alterations:
energycodeace.com/content/resources-trigger-sheets/
- Please register with the site and select an industry role for your profile in order to receive messages about all our free offerings!



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