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
  - $\geq 75\%$ of new duct system
  - Up to $25\%$ existing duct system components may be reused, if accessible and can be sealed

Note: $\leq 40$ ft of altered or extended duct does not trigger compliance documentation or duct leakage testing. It must meet mandatory R-6 insulation only.

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>1 through 10, 12 &amp; 13</th>
<th>11, 14 through 16</th>
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<tbody>
<tr>
<td>Duct R-Value</td>
<td>R-6</td>
<td>R-8</td>
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</tbody>
</table>

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.

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

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 airflow. (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 airflow. (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 ≤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 efficiency ≤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)
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.
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/section1502energyefficiencystandardsforadditionsandalterations.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/

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