



CALIFORNIA ENERGY COMMISSION

Residential Alterations and the 2013 Energy Standards

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Goals of this Training

- Clarify the Energy Standards Prescriptive requirements for residential alterations:
 - Water heater alterations
 - Reroofs
 - HVAC alterations
- Simplify compliance for permit technicians and clarify:
 - Which form is required at permit
 - What measures/efficiencies to verify
- Increase CEC staff knowledge about daily operations for permit technicians and their concerns/needs



QUESTIONS...

- **Please feel free to ask at anytime!**
 - During training
 - At break
 - Afterwards
- **Your questions will enhance this training**





A Little CEC History

- Section 25402 of the Public Resources Code (known as the **Warren Alquist Act**)
- The act created the Energy Commission in 1974 and gave it authority to develop and maintain Building Energy Efficiency Standards
- Requires the Standards and new requirements to be cost effective over the economic life of the structure
- Requires the Energy Commission to update the Standards periodically (about every 3 years)



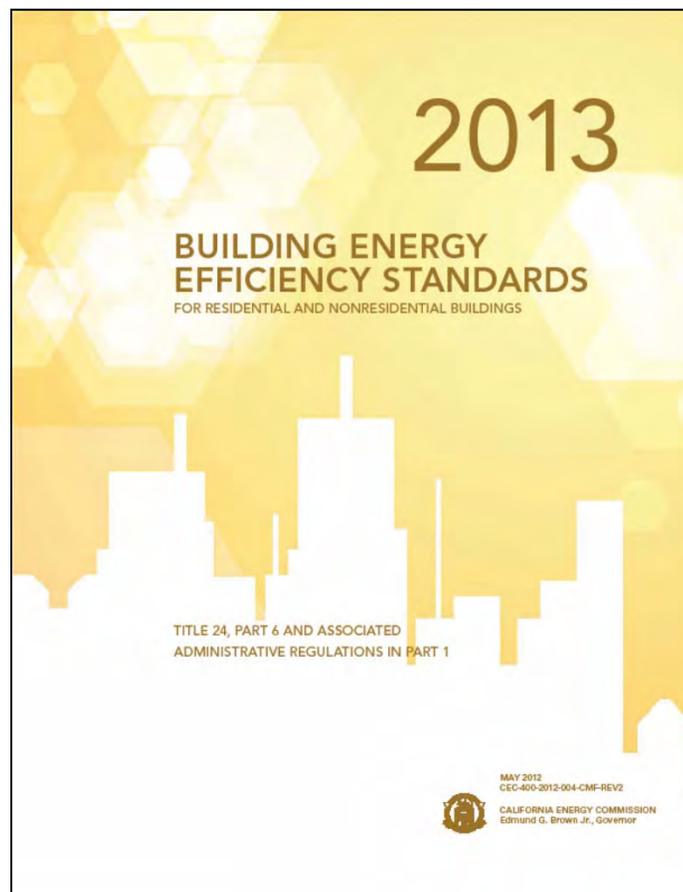
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*Let's discuss the 2013
Building Energy Efficiency
Standards*



2013 Building Energy Efficiency Standards

- **Effective on July 1, 2014**
 - Building permit applications submitted on or after this date
- **Master plans in plan review may be affected:**
 - Need to resubmit if permits pulled on/after effective date

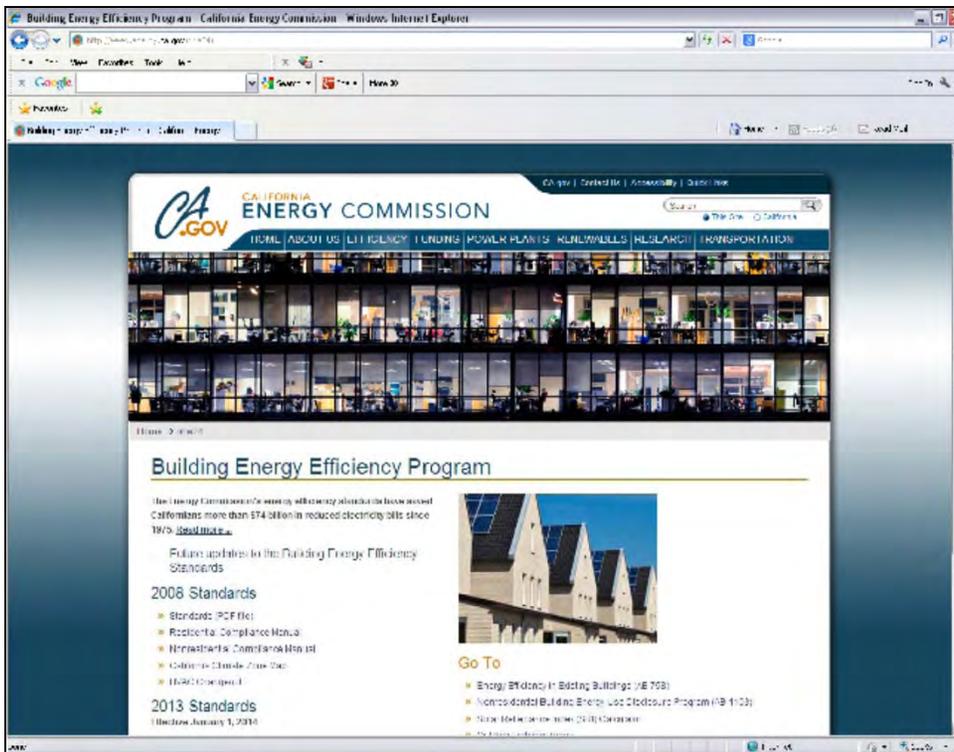




2013 Documents

- Building Energy Efficiency Standards
- Residential Compliance Manual
- Reference Appendices
- All docs. available online at:

www.energy.ca.gov/title24





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*Let's talk about water heater
alterations*



What triggers compliance?

- When a water heater is:
 - Replaced
 - Added (new)
- OR, when water heating piping is replaced or added
- Only the altered components need to comply





Water heater requirements

- **Meet minimum efficiency requirements**
 - Gas storage water heaters ≤ 55 gallons
 - $[0.675 - (0.0015 \times V)]$
- **Must be gas or propane (heat pumps OK)**
 - Electric water heater allowed ONLY if natural gas is not available
- **Meet pipe insulation requirements**
 - 1" for pipes with diameter 1" or less
 - 1.5" for pipes with diameter greater than 1"



California Energy Commission
2013 Building Energy Efficiency Standards
Minimum Water Heater Energy Factor
Reference Guide

Gas-fired

Volume	Federal Minimum Energy Factor
30	0.63
35	0.62
40	0.62
45	0.61
50	0.60
55	0.59
60	0.75

Instantaneous Gas-fired

Volume	Federal Minimum Energy Factor
< 2 gallons	0.82

Electric

Volume	Federal Minimum Energy Factor
30	0.95
35	0.95
40	0.95
45	0.95
50	0.95
55	0.94
60	1.99

Instantaneous Electric

Volume	Federal Minimum Energy Factor
< 2 gallons	0.93

Tabletop

Volume	Federal Minimum Energy Factor
30	0.89
35	0.88
40	0.88
45	0.87
50	0.86
55	0.86
60	0.85

Oil-fired

Volume	Federal Minimum Energy Factor
30	0.62
35	0.61
40	0.60
45	0.59
50	0.59
55	0.58
60	0.57

Energy factors were determined using the equations in 10 CFR 430.31(d) (<http://www.gpo.gov/fdsys/pkg/CFR-2012-title10-vol3/pdf/CFR-2012-title10-vol3-sec430-32.pdf>).



California Energy Commission
2013 Building Energy Efficiency Standards
Minimum Water Heater Energy Factor
Reference Guide

To be used for prescriptive alterations only. The energy factor is climate zone dependent.

Heat Pump

Climate Zone	Minimum Required Energy Factor
1	2.75
2	2.75
3	2.75
4	2.80
5	2.75
6	2.33
7	2.50
8	2.33
9	2.33
10	2.33
11	2.50
12	2.80
13	2.50
14	2.50
15	2.33
16	3.00 plus a solar water heating system with solar savings fraction ≥ 0.4

Per Section 150.2(b)1Giv of the Energy Standards, the California Energy Commission used the performance compliance approach to determine the minimum energy factor (EF) needed to be able to prescriptively replace an existing water heater with a heat pump water heating system. A heat pump water heating system, meeting these minimum EFs, can replace an existing water heater regardless of original fuel type (natural gas, LPG, or electric).

The EFs listed for heat pump water heating systems can only be used for residential single dwelling unit alterations.

H. WATER HEATING SYSTEMS

Water heating compliance for an alteration is described in Section 150.2(b)1G. For a single dwelling unit, a gas or propane water heater that meets the requirements of 150.1(c)8 can be used. If no natural gas is connected to the building, an electric water heater with an energy factor greater than or equal to the minimal energy factor required under the Appliance Efficiency Regulation, and with a storage capacity of less than 60 gallons can be used. Dwelling Unit distribution systems are limited to standard trunk and branch or demand recirculation for gas or propane water heaters. Demand recirculation is not allowed for electric water heaters. If there is no natural gas connected to the building, an electric water heater may be replaced with another electric water heater. However, changing from gas to electric is not allowed. Multi-family central systems must use certified equipment as defined under Section 110.1 and 110.3.

NOTE: If the proposed installation does not meet the requirements allowed specifically for alterations, use form CF1R-NCB-01 to document the water heater alteration.

1. Dwelling Unit Name: Name of dwelling unit or any other identifying name.
2. Water Heating System Identification or Name: Name of the Water Heating System or any other identifying name.
3. Water Heating System Location or Area Served: Zone, or area, served by the Water Heating System.
4. Water Heating System Type: Domestic Hot Water (DHW), Hydronic, Combined Hydronic, or Central. DHW is for domestic hot water, hydronic is a water heating system used for space heating only; combined hydronic is when the water heater will provide both space conditioning and domestic hot water.
5. Water Heater Type: For non-central systems only Small Storage or Small Instantaneous are allowed. For central systems pick from Large Storage, Small Storage, Heat Pump, Boiler, Large Instantaneous, Small Instantaneous or Indirect.
6. Number of Water Heaters in System: In single-family and multi-family with water heaters in each dwelling unit the value is 1. For multi-family central systems serving multiple dwelling units enter the total number of water heaters.
7. Water Heater Storage Volume: Tank capacity in gallons. For individual water heaters for a dwelling unit this will be 60 gallons or less. If instantaneous enter n/a. For multi-family central systems enter the total storage volume.
8. Fuel Type: Gas, Propane, Electric (Only if natural gas is not available)
9. Rated Input Type: Enter the equipment input rating type, for gas or propane fired units are Btuh, for electric fired system the units are kW.
10. Rated Input Value: Enter the numeric value of rated input.
11. Heating Efficiency Type: Energy Factor, AFUE, or Thermal Efficiency. From product literature or a California Energy Commission directory.
12. Heating Efficiency Value: Enter the value from product literature or a California Energy Commission directory
13. Standby Loss (%): Applies only to large storage water heaters; enter n/a for small storage or instantaneous water heaters.
14. Exterior Insulation R-Value: Enter the R-value if exterior insulation on the storage tank is installed
15. Back-Up Solar Savings Fraction: If compliance requires a back-up solar system, indicate the solar contribution (e.g., 0.30). External calculations are required.



Forms Exception Rule

§10-103

- For alterations that do not require HERS testing:
 - Building Department may not require CF1R form
 - OR, can create simplified version of CF1R
- Does not exempt applicant from complying with code; only forms
- Recommend including requirements on permit application for simplification (i.e. water heater type, energy factor, tank insulation, etc.)



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QUESTIONS...

About Water Heater Alterations?





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Let's talk about reroofs



What triggers compliance?

- When more than 50% of the roof is being replaced
- Only the altered roofing area need comply (cool roof)





Cool Roof requirements

- **Steeped-sloped roofs, Climate Zones 10 – 15:**
 - Minimum aged solar reflectance of 0.20; and
 - Thermal emittance of 0.75
 - OR, SRI of 16
- Numerous exceptions may be installed (or already existing) as equivalent
- Must be certified to the Cool Roof Rating Council (CRRC)
- Blueprint Issue 107 outlines requirements

- a. Air-space of **1.0 inch (25 mm)** is provided between the top of the roof deck to the bottom of the roofing product; or
- b. **The installed roofing product has a profile ratio of rise to width of 1 to 5 for 50 percent or greater of the width of the roofing product;** or
- c. Existing ducts in the attic are insulated and sealed according to Section 150.1(c)9; or
- d. Buildings with at least **R-38** ceiling insulation; or
- e. Buildings with a radiant barrier in the attic meeting the requirements of Section 150.1(c)2; or
- f. Buildings that have no ducts in the attic; or
- g. In Climate Zones 10-15, **R-4** or greater insulation above the roof deck.

CERTIFICATE OF COMPLIANCE	CF1R-ALT-05-E
Prescriptive Residential Alterations That Do Not Require HERS Field Verification	(Page 3 of 8)
Project Name:	Date Prepared:

C. ROOF REPLACEMENT (Prescriptive Alteration, Section 150.2(b)1H) ←

01	02	03	04	05	06	07	08	09	10	11	12	13
Method of Compliance	Roof Pitch	Exception	CRRC Product ID Number	Product Type	R-value Deck Insulation	Proposed			Minimum Required			
						Initial Solar Reflectance	Aged Solar Reflectance	Thermal Emittance	SRI (Optional)	Aged Solar Reflectance	Thermal Emittance	SRI (Optional)

NOTES

- Roof area covered by building integrated photovoltaic panels and solar thermal panels are exempt from the above Cool Roof requirements.
- Liquid field applied coatings must comply with installation criteria from section 110.8(i)4.

D. FENESTRATION/GLAZING AREAS ALLOWED (Section 150.2(b)1)

01	02		03	04		05		06		07
Alteration Type	Maximum Allowed Fenestration Area For All Orientations (ft ²) (Windows)	Maximum Allowed Fenestration Area For All Orientations (ft ²) (Skylights)	Maximum Allowed West-Facing Fenestration Area Only (ft ²)	Existing Fenestration Area for All Orientations (ft ²)	Existing West-Facing Fenestration Area (ft ²)	Maximum Allowed U-factor (Windows)	Maximum Allowed U-factor (Skylights)	Maximum Allowed SHGC (Windows)	Maximum Allowed SHGC (Skylights)	Comments

C. ROOF REPLACEMENT (Prescriptive Alteration, Section 150.2(b)1H)

When 50% or more of the roof is being replaced the roofing requirements are triggered. Any areas of roof covered by building integrated photovoltaic panels and solar thermal panels (the area of roof not covered by photovoltaic panels would still need to meet any applicable cool roof requirements). Additionally, there are many alternatives/exceptions to when a cool roof is required.

When the roof is steep slope (pitch greater than 2:12) the roof requirements include a cool roof in climate zones 10-15. The minimum requirement is 0.20 Aged Solar Reflectance, 0.75 Thermal Emittance, or a minimum SRI of 16.

1. Method of Compliance: Indicate if the method of compliance is going to be based on Aged Solar Reflectance and Thermal Emittance, the Solar Reflectance Index (SRI), or an Exception.
2. Roof Pitch: Expressed as 4:12, for example, which means the roof rises 4 foot within a span of 12 feet. When roofs have multiple pitches the requirements are based on the pitch of 50% or more of the roof.
3. Exception: If meeting one of the exceptions. Indicate which exception is, or will be, met.

NOTES: EXCEPTIONS AND ALTERNATIVES FOR STEEP SLOPE ROOFS:

- (a) Mass roof 25 lbs/ft² or greater (uncommon situation such as sod roof);
- (b) Air space 1" from top of roof deck to bottom of roofing;
- (c) Roofing product has a profile ratio of rise to width of 1 to 5 for 50 percent or greater of the width of the roofing product;
- (d) Ducts already meet Section 150.1(c) insulation and duct leakage requirements;
- (e) Roof has R-38 insulation;
- (f) Roof has a radiant barrier;
- (g) No ducts are installed in the attic; or
- (h) R-4 insulation above the roof deck.

In climate zones 13 & 15, when there is a low slope roof (pitch 2:12 or less) the cool roof requirements are for a minimum Aged Solar Reflectance of 0.63, a minimum 0.75 Thermal Emittance, or a minimum SRI of 75.

NOTES: EXCEPTIONS AND ALTERNATIVES FOR LOW SLOPE ROOFS:

- (a) Mass roof 25 lbs/ft² or greater (uncommon situation such as sod roof);
- (b) No ducts are installed in the attic; or
- (c) Roof deck insulation—by installing roof deck insulation, a lower aged solar reflectance is required: R-2 (0.62-0.60), R-4 (0.59-0.55), R-6 (0.54-0.50), R-8 (0.49-0.45), R-12 (0.44-0.40), R-16 (0.39-0.35), R-20 (0.34-0.30), R-24 (0.29-0.25).

NOTE: If one of the exceptions above has been selected then the rest of Section C is Not Required.

4. CRRC Product ID Number: The CRRC Product ID Number is obtained from the Cool Roof Rating Council’s Rated Product Directory at www.coolroofs.org/products/results . Products are listed by manufacturer, brand, type of installation, roofing material, and color, as well as product performance.
5. Product type: See Cool Roof Rating Council’s directory. Generally product types include single-ply roof, wood shingles, asphalt roof, metal roof, tile roof.
6. R-value Deck Insulation: If one of the exceptions selected includes adding roof deck insulation, indicate the R-value of the insulation.
7. Proposed Initial Solar Reflectance: Based on the product chosen from the Cool Roof Rating Council’s Rated Product Directory. If using default assumption indicate NA since the Aged Solar Reflectance is available.
8. Proposed Aged Solar Reflectance: Value is from the Cool Roof Rating Council’s Rated Product Directory. If the aged value is not available, calculate the Aged Solar Reflectance using the Solar Reflectance Index (SRI) Calculation worksheet located on the California Energy Commission website or the aging equation $\rho_{aged}=[0.2+\beta[\rho_{initial}-0.2]]$, where $\rho_{initial}$ = the initial solar reflectance and soiling resistance β is listed by product type below.

VALUES OF SOILING RESISTANCE β BY PRODUCT TYPE

Product Type	CRRC Product Category	β
Field-Applied Coating	Field-Applied Coating	0.65
Other	Not A Field-Applied Coating	0.70

9. Proposed Thermal Emittance: From the product specification default value. If using a calculated SRI place the Thermal Emittance used to calculate SRI.
10. Proposed SRI: It is optional to meet the SRI but if chosen to do so, use the Solar Reflectance Index (SRI) Calculation Worksheet found on the California Energy Commission website <http://www.energy.ca.gov/title24/> .
11. Minimum Required Aged Solar Reflectance: Based on climate zone and roof slope.
12. Minimum Required Thermal Emittance: Based on climate zone and roof slope.
13. Minimum Required SRI: Based on climate zone and roof slope.

NOTE: If the cool roofing requirements will be met by a liquid field applied coating, Section 110.8(i)4 requires the coating be applied across the entire roof surface and meet the dry mil thickness or coverage recommended by the manufacturer.



Forms Exception Rule

§10-103

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QUESTIONS...

About reroofs??





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*Let's talk about HVAC
alterations*



What triggers compliance?

- When a new space conditioning system is replaced or installed
 - Equipment and ducting
- When ducting is replaced or installed
- HVAC changeouts
 - Equipment only
- HVAC [Trigger Sheet](#) developed by Energy Code Ace

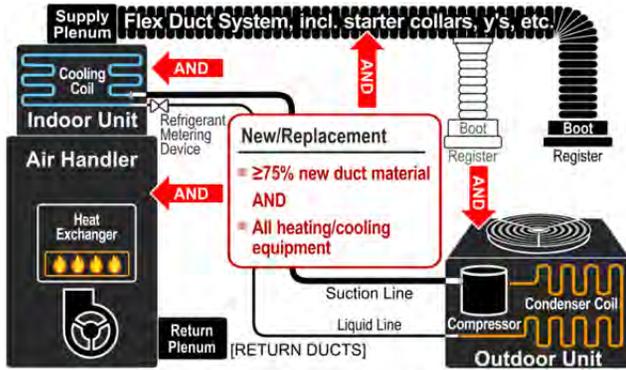
Split Systems and Packaged Systems	Mandatory Measures					Prescriptive Requirements	
	Setback Thermostat §110.2(c) §150.2(b)F	Cooling Load Calcs §150.0(h), §150.2(b)1C	Heating Load Calcs §150.0(h), §150.2(b)1C	HERS: Duct Seal and Test §150.0 (m)1-3 & 11 §150.2(b)1C,D, & E	HERS: Cooling Coil Airflow and Fan Watt Draw §150.0(m)12, 13 & 15 §150.2 (b)1C, D	Duct Insulation §150.1(c)9 §150.2(b)1D	HERS: Refrigerant Charge §150.1(c)7 A §150.2(b)1 F
Change this (and nothing else)							
Whole split or packaged system (no ducts added or replaced)	YES	no	no ^A	YES ^B	no	no	YES ^{C, D}
Evaporator coil (cooling coil), condenser coil, or outdoor condensing unit	YES	no	no ^A	YES ^B	no	no	YES ^{C, D}
Furnace (air handler)	YES	no	no ^A	YES ^B	no	no	YES ^{C, D}
Compressor, refrigerant metering device	YES	no	no ^A	no	no	no	YES ^{C, D}
Some ducts	no	maybe ^E	maybe ^{A, E}	YES ^B	no	YES ^F	no
"All new" ducts ^G	no	maybe ^E	maybe ^{A, E}	YES ^H	YES ^I	YES ^F	no
Whole split or packaged system and all new ducts	YES	YES ^E	YES ^{A, E}	YES ^H	YES ^I	YES ^F	YES ^{C, D}

NOTE:

- ✦ Replacing the blower wheel fan is considered a repair and does NOT trigger the Standards.
- ✦ All new HVAC equipment must meet minimum federal efficiency requirements
- ✦ Cooling line insulation is triggered if the line set (cooling system, suction line) is replaced or repaired. Line sets ≤1.5" in diameter must have 0.5" thick insulation.

- ^A Heating equipment must meet CBC minimum capacity requirements.
- ^B Unless exceptions apply, duct systems must be sealed and verified if >40 feet of ducts in unconditioned space. Duct system leakage must be ≤15% in total, or ≤10% to the outside. Or, if unable to meet the sealing requirements, all accessible leaks must be sealed and verified by a HERS rater.
- ^C HERS verification of refrigerant charge is required in **climate zones 2 and 8–15 only** when a refrigerant containing component of an air conditioner or heat pump is replaced or installed in an existing building.
- ^D Although there are no commercially available HVAC systems with approved Charge Indicator Display (CID) devices at the time of publication (July 2014) the Standards do allow use of a CEC-approved CID should such equipment become available during the 2013 code cycle.
- ^E Cooling and heating load calculations are required when ducts are added to **serve new conditioned space**, such as an addition.
- ^F When adding or replacing >40 feet of ducts in unconditioned space: CZ 1-10 and 12-13: R-6; CZ 11 and 14-16: R-8. HERS verification is required for insulated ducts in conditioned space. Mandatory duct insulation requirements (R-6) apply to all new or replacement ducts (not existing or unaltered ducts).
- ^G The system is considered to have "all new" ducts when 75% or more of the ducts are new material and up to 25% reused parts from the existing duct system (e.g., registers, grilles, boots, air handler, coil, plenums, duct material) if the reused parts are accessible and can be sealed to prevent leakage.
- ^H In all climate zones, when new duct systems are installed in unconditioned space, leakage must be ≤6% of the air handler airflow.
- ^I When new duct systems are installed, cooling coil airflow must be >350 CFM per ton, and fan watt draw must be ≤0.58W/CFM. Alternatively, the system can meet the requirements in Table 150.0-C or Table 150.0-D (Return Duct Sizing and Filter Sizing).

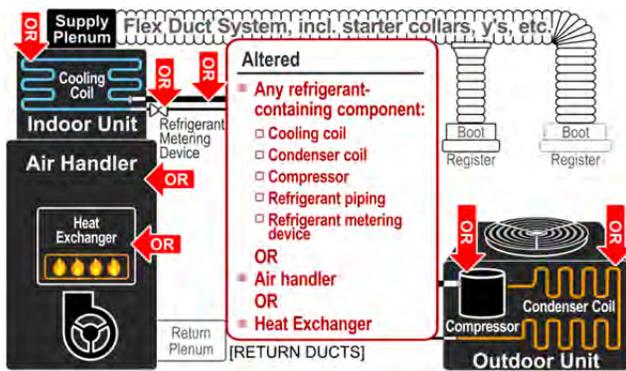
2013 Entirely New or Complete Replacement Space-Conditioning System §150.2(b)1C



A space-conditioning system is considered entirely new or a complete replacement when all of the following are installed or replaced:

- ✦ All the system heating/cooling equipment
- ✦ ≥75% new duct material ^G

2013 Altered Space-Conditioning System §150.2(b)1E, F



A space-conditioning system is considered altered when it is not a new or replacement 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
- ✦ Air handler
- ✦ 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.

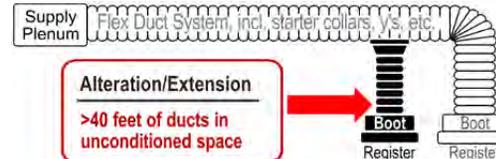
2013 Altered or Replaced Duct Systems (Duct Sealing) §150.2(b)1D



Entirely New or Complete Replacement Ducts

Entirely new or complete replacement duct systems are those that contain at least 75% new duct material. Existing duct system components (up to 25%) may be reused if they are accessible and can be sealed.^G

The Duct Sealing and Testing HERS measure must demonstrate a leakage rate less than or equal to 6% 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 airflow >350 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy ≤0.58 W/CFM.



Alteration or Extension of Existing Ducts

In all climate zones when more than 40 feet of new or replacement system ducts are installed as an extension of an existing duct system, Duct Sealing and Testing (HERS measure) is required, and the measured leakage shall be equal to or less than 15% of system air handler air flow.

(There are alternatives to meeting the maximum 15% leakage. Consult your Building Department or §150.2(b)1Diib in the Standards.)

Required Documentation

For All HVAC Alterations

All HVAC alterations require:

- ✦ Permit — for all HVAC changeouts
- ✦ CF1R: Certificate of Compliance: Alteration to an HVAC System (CF1R-ALT-02*-E, or CF1R-ALT-03-E or CF1R-ALT-04-E)
Submitted to the building department by the contractor or the home owner
- ✦ CF2R-MCH-01-H: 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

For HERS Measures

Projects with HERS measures require:

- ✦ Registration of the CF1R, via HERS Provider
 - ✦ CF2R-MCH...H: Certificates of Installation for mechanical system with HERS measures
Completed and signed by the installing contractor; must be submitted to a HERS Provider Registry after the contractor has signed it, and made available for inspection by the building department
 - ✦ CF3R-MCH...H: Certificates of Field Verification for mechanical system with HERS measures
Completed and registered by a HERS Rater for each CF2R-H; the HERS Rater or contractor ensures the relevant CF3Rs are available for final inspection by the building department.
 - ✦ HERS: Duct Leakage Diagnostic Test
 - ❖ CF2R-MCH-20*-H and CF3R-MCH-20*-H
 - ✦ HERS: Fan Efficacy (Fan Watt Draw)
 - ❖ CF2R-MCH-22-H and CF3R-MCH-22-H
 and
 HERS: Space Conditioning System Airflow Rate
 - ❖ CF2R-MCH-23*-H and CF3R-MCH-23*-H
 - ✦ HERS: Refrigerant Charge Verification
 - ❖ CF2R-MCH-25*-H and CF3R-MCH-25*-H
 - or
 - ❖ CF2R-MCH-25f-E (for packaged systems with refrigerant charge certified by manufacturer)
- * *Correct version (e.g., "a" or "b" or "c") varies depending upon the project scope and approach used to demonstrate compliance*

For Projects with New or Replacement Duct Systems using Duct and Filter Sizing

Projects that use Duct and Filter Sizing instead of the Cooling Coil Airflow and Fan Watt Draw HERS Measure require:

- ✦ CF2R-MCH-28-H and CF3R-MCH-28-H



HVAC requirements

- **Depending on what is altered:**
 - Minimum efficiency requirements for A/C and furnace
 - Duct insulation
 - HERS Testing (Duct leakage; Airflow and Fan Watt Draw; Refrigerant Charge)
 - CF1R must be registered with approved HERS Provider
 - Per §10-103, Building Department may except hand written CF1R at permit; all registered forms submitted at Final inspection



New space cond. system

2008 – §152(b)1C

- Min. R-4.2 duct insulation
- Duct leakage req. in Cl. Zns. 2 and 9 – 16
- Airflow/FWD req. in Cl. Zns. 10 – 15
- RC req. in Cl. Zns. 2 and 8 – 15 for split systems
- Forms must be registered

2013 – §150.2(b)1C

- Min. R-6.0 duct insulation
- Duct leakage req. in ALL Cl. Zns.
- Airflow/FWD req. in ALL Cl. Zns.
- RC req. in same Cl. Zns for split and packaged A/Cs and heat pumps, and mini-split systems



Replace/New System and the Permit Process

- **CF1R-ALT-02 form**
 - Can req. at Final
 - HERS tests/forms specified
- **Verify at Final:**
 - Duct insulation \geq R-6.0 (MCH-1)
 - Duct leakage (MCH-20)
 - AF/FWD (MCH 22 and 23)
 - RC (MCH-25)



ALTERATION TO HVAC SYSTEM

CEC-CF1R-ALT-02-E (Revised 06/13)

CALIFORNIA ENERGY COMMISSION



CERTIFICATE OF COMPLIANCE		CF1R-ALT-02-E
Alteration to an HVAC System		(Page 1 of 2)
Project Name: 2013 CALBO Training Sample	Date Prepared: 01/01/14	

A. GENERAL INFORMATION					
1	Project Name:	CALBO Changeout	2	Date Prepared:	01/01/14
3	Project Location:	Black Oak Hills	4	Building Type:	Single Family
5	CA City:	Sacramento	6	Dwelling Unit Name:	
7	Zip Code:	95814	8	HVAC System Identification or Name:	HVAC 1
9	Climate Zone:	12	10	CFA served by HVAC System (ft ²):	1,500 ft²
11	Alteration Type:	Entirely New or Complete Replacement Space Conditioning System	12	HVAC System Location or Area Served	Whole House

B. - ALT-02d - Entirely New or Complete Replacement Space Conditioning System (Section 150.2(b)1C)										
1	2	3		4	5	6		7	8	9
Heating System Type	Altered Heating Component	Required Min Heating Efficiency AFUE or HSPF		Cooling System Type	Altered Cooling Components	Required Min Condenser Efficiency SEER or EER		Required Thermostat Type	New or Replaced Duct Length (ft)	Req'd Min New Duct R-Value
Furnace	Furnace	78	7.7	Split Sys AC	Condenser, coil, compressor, refrigerant line set	13	N/A	Setback	20 ft	R-6

C. Certificate of Installation Documents Required	
CF2R-MECH-01-E	
CF2R MECH-20-H – Duct Leakage	
CF2R MECH-22-H – Fan Efficacy	
CF2R MECH-23-H - Airflow	
CF2R MECH-25-H – Refrigerant Charge	

D. Certificate of Verification Documents Required	
CF3R MECH-20-H – Duct Leakage	
CF3R MECH-22-H – Fan Efficacy	
CF3R MECH-23-H - Airflow	
CF3R MECH-25-H – Refrigerant Charge	



Duct alterations

2008 – §152(b)1D

- When more than 40 linear feet added/replaced in uncond. space:
 - Min. R-4.2 duct insulation
 - Duct leakage req. in Cl. Zns. 2 and 9 – 16
 - 6% for new duct systems
 - Less than 15%
 - Less than 10% to outside
 - Reduce leakage by 60%
 - Smoke test

2013 – §150.2(b)1D

- When more than 40 linear feet added/replaced in uncond. or indirectly conditioned space:
 - Min. R-6.0 duct insulation
 - Duct leakage req. in ALL Cl. Zns.
 - 6% leakage req. when more than 75% of ducting replaced
 - Reduce leakage by 60% option removed



Duct Alterations and the Permit Process



- **CF1R-ALT-02 form**
 - Can req. at Final
 - Duct leakage [specified](#)
- **Verify at Final**
 - Duct insulation \geq R-6.0
 - Uncond. and indirectly cond. space
 - Duct Leakage (MCH-20)
 - ALL Climate Zones

ALTERATION TO AN HVAC SYSTEM

CEC-CF1R-ALT-02-E (Revised 06/13)



CERTIFICATE OF COMPLIANCE	CF1R-ALT-02-E
Alteration to an HVAC System	(Page 1 of 2)
Project Name:	Date Prepared:

A. GENERAL INFORMATION					
01	Project Name:		02	Date Prepared:	
03	Project Location:		04	Building Type:	
05	CA City:		06	Dwelling Unit Name:	
07	Zip Code:		08	HVAC System Identification or Name:	
09	Climate Zone:		10	CFA served by HVAC System (ft ²):	
11	Alteration Type:		12	HVAC System Location or Area Served	

B. ALT-02a – Extension of Existing Duct System, Greater Than 40 Feet (Section 150.2(b)1Diib)										
01	02	03		04	05	06		07	08	09
Heating System Type	Altered Heating Component	Required Min Heating Efficiency AFUE or HSPF		Cooling System Type	Altered Cooling Components	Required Min Condenser Efficiency SEER or EER		Required Thermostat Type	New or Replaced Duct Length (ft)	Req'd Min New Duct R-Value
									45 ft	R-6

C. Certificate of Installation Documents Required
CF2R-MECH-01-E
CF2R MECH-20-H – Duct Leakage

D. Certificate of Verification Documents Required
CF3R MECH-20-H – Duct Leakage



HVAC Changeouts

2008 – §152(b)1E, F

- Duct leakage req. in Cl. Zns. 2 and 9 – 16
 - Less than 15%
 - Less than 10% to outside
 - Reduce leakage by 60%
 - Smoke test
- RC req. in Cl. Zns. 2 and 8 – 15 for split systems

2013 – §150.2(b)1E, F

- Duct leakage req. in ALL Cl. Zns.
 - Reduce leakage by 60% option removed
- RC req. in same Cl. Zns. for:
 - Split A/Cs and heat pumps
 - Packaged A/C and heat pumps
 - Mini-split systems



Changeouts and the Permit Process

- **CF1R-ALT-02 form**
 - Can req. at Final
 - HERS tests/forms specified
- **Verify at Final:**
 - Duct leakage (MCH-20)
 - RC (MCH-25)
 - AF (MCH-23)



ALTERATION TO AN HVAC SYSTEM

CEC-CF1R-ALT-02-E (Revised 06/13)



CERTIFICATE OF COMPLIANCE	CF1R-ALT-02-E
Alteration to an HVAC System	(Page 1 of 2)
Project Name:	Date Prepared:

A. GENERAL INFORMATION					
01	Project Name:		02	Date Prepared:	
03	Project Location:		04	Building Type:	
05	CA City:		06	Dwelling Unit Name:	
07	Zip Code:		08	HVAC System Identification or Name:	
09	Climate Zone:		10	CFA served by HVAC System (ft2):	
11	Alteration Type:		12	HVAC System Location or Area Served	

B. ALT-02b – Altered Space Conditioning System (Sections 150.2(b)1E and F)										
01	02	03		04	05	06		07	08	09
Heating System Type	Altered Heating Component	Required Min Heating Efficiency AFUE or HSPF		Cooling System Type	Altered Cooling Components	Required Min Condenser Efficiency SEER or EER		Required Thermostat Type	New or Replaced Duct Length (ft)	Req'd Min New Duct R-Value
Furnace	Furnace	78	N/A	Split A/C	Condenser coil	13	N/A	Setback	N/A	N/A

C. Certificate of Installation Documents Required
CF2R-MECH-01-E
CF2R MECH-20-H – Duct Leakage
CF2R MECH-25-H – Refrigerant Charge
CF2R MECH-23-H - Airflow

D. Certificate of Verification Documents Required
CF3R MECH-20-H – Duct Leakage
CF3R MECH-25-H – Refrigerant Charge
CF3R MECH-23-H - Airflow



HERS Providers

Currently, 3 HERS Providers are approved for residential alterations (2013 Standards):

- **CalCERTS:**

<https://www.calcerts.com/>

- **U.S. Energy Raters Association (USERA)**

<http://www.usenergyraters.com/>

- **Energy Analysis & Comfort Solutions, Inc. (EACS)**

<http://www.eacsinc.com/>



CALIFORNIA ENERGY COMMISSION

QUESTIONS...

About HVAC alterations?





In Summary

- The Energy Standards have requirements for water heater alterations, re-roofs, and HVAC alterations
- Compliance can be verified on CF1R form
- Building Departments may exempt projects from having to submit the CF1R form for alterations that do not require HERS Testing
 - Can include requirements on permit application
- The CF1R form must be registered at either permit or Final inspection when HERS testing is required (HVAC alterations)



Resources - Blueprint

- Published every other month
- Clarifications on frequently asked questions
- Receive by e-mail
- <http://www.energy.ca.gov/efficiency/blueprint/>

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CALIFORNIA ENERGY COMMISSION

BLUEPRINT

EFFICIENCY DIVISION

Issue 107 January - February 2015

In This Issue

- Cool Roofs & Condensation
- QII Compliance Credit for Insulated Headers
- Approved Acceptance Test Technician Certification Providers for Lighting Controls
- Free Training Opportunities
- Q&A
 - Commissioning
 - Nonresidential Economizers
 - Residential Reroof Projects
 - Luminaire Modifications-In-Place

Cool Roofs & Condensation

A cool roof is a roofing material with high thermal emittance and high solar reflectance, or low thermal emittance and exceptionally high solar reflectance that reduces heat gain through the roof. Because cool roofs gain and retain less heat than traditional roofs, less heat is transferred through the envelope into

the building's interior. By lowering internal temperatures, cool roofs reduce occupant demand for air conditioning, allowing for building cooling cost savings.

The temperature of the cool roof is reduced to such an extent that moisture no longer evaporates as it would with a traditional roof. When cool roofs are not installed properly, moisture condenses and becomes trapped within the roofing materials. The trapped moisture can lead to mold growth and damage to the roofing materials or supporting elements.

To prevent the trapping of moist air, it is essential to follow proper air sealing procedures as outlined in [Section 110.7](#) of the 2013 Building Energy Efficiency Standards (Energy Standards). Proper installation may require the installation of: air barriers, vapor barriers, insulation above the roof deck, and additional ventilation.

For more information on cool roofs, please review the U.S. Department of Energy's *Energy Saver* article "Cool Roofs" at: <http://www.energy.gov/energysaver/articles/cool-roofs>.

Quality Insulation Installation (QII) Compliance Credit for Insulated Headers

The 2013 Energy Standards provide Quality Insulation Installation (QII) compliance credit for R-2 insulated headers as indicated in [Section RA3.5.6.2.9](#) of the 2013 Reference Residential Appendices (RA). Insulation or wood must fill the cavities, leaving no air gaps in or around the header. To obtain QII credit, use compliance document [CF2R-ENVY-21-11](#). Compliance with the R-2 insulated header requirement is verified in Section C, number 13 of this compliance document.

Three options meet the R-2 insulated header requirement:

1. Two-member header with insulation in between. The header and insulation must fill the wall cavity. Example: a 2x4 wall with two 2x nominal headers, or a 2x6 wall with a 4x nominal header and a 2x nominal header. Insulation is required to fill the wall cavity and must be installed between the headers.



Resources - Fact Sheets

- 5 published to date
- Detailed clarifications on specific topic/requirements
- Receive by e-mail (listserver)
- <http://www.energy.ca.gov/efficiency/factsheets/>

FACT SHEET

CALIFORNIA ENERGY COMMISSION

Envelope Air Sealing

2013 California Energy Efficiency Building Standards

What is envelope air sealing?
Envelope air sealing is the process of limiting infiltration and exfiltration of air through the building envelope, the interface between the interior of the building and the outdoor environment. This process includes caulking, gasketing, weatherstripping, or otherwise sealing all joints, penetrations and other openings to limit air leakage.

When is envelope air sealing required?
Envelope air sealing is required when constructing, adding to, or altering residential and nonresidential buildings.

Why air seal the building envelope?
Air sealing of the building envelope is required by [Section 110.2](#) of the 2013 Building Energy Efficiency Standards (Energy Standards) and has been required since 1982. Buildings with improperly sealed envelopes experience higher rates of air leakage, which can result in increased energy use to heat or cool the building. This in-turn can lead to increased energy bills.

What are some of examples of what must be sealed?

- Exterior joints around window and door frames, including doors between the house and garage, between interior HVAC closets and conditioned space, between attic accesses and conditioned space, between wall sole plates and the exterior floor panels;
- Exterior wall air barrier at the top and bottom plates;
- Openings for plumbing, electricity, and gas lines in exterior walls, ceilings and floors;
- Openings in the attic floor, including where ceiling panels meet interior and exterior walls and masonry fireplaces;
- Openings around exhaust ducts such as those for clothes dryers;
- Field-fabricated operable windows and doors must have weatherstripping, and
- All other such openings in the building envelope.

Please see Figure 1³ for common air leakage paths.

When is a compliance document required?
A CF2R-ENV-02-E compliance document is required when a residential building envelope is constructed, added to, or altered.
An NRCI-ENV-01-E compliance document is required when a non-residential building envelope is constructed, added to, or altered.



Figure 1 - Location of Common Air Leakage Paths³



Resources - Training

- Provided by Utilities
- Free of charge
- Can request for training in your region/area
- CEC training
- <http://www.energy.ca.gov/title24/training/>

The screenshot shows the California Energy Commission website. The header includes the CEC logo, the text 'CALIFORNIA ENERGY COMMISSION', and a search bar. The navigation menu lists: Home, About Us, Analysis & Stats, Efficiency, Funding, Power Plants, Renewables, Research, and Transportation. The main content area is titled 'Title 24 Training' and contains the following text:

» Education and training are important in order to understand and comply with the current Building Energy Efficiency Standards, and to use compliance software.

» This page focuses on training; also see the [Educational Resources page](#) for other opportunities. The Energy Commission coordinates with utility partners and stakeholder organizations to offer frequent opportunities to enhance your skills and awareness of the Building Energy Efficiency Standards.

» Please [subscribe to the Building Standards Listserv](#) to receive information about the Building Energy Efficiency Standards, Compliance Software, and educational opportunities.

Energy Standards Training

Overview Webinars

- 2013 Residential Energy Standards Overview, January 16, 2014
[Presentation](#) [WebEx Recording](#)
- 2013 Nonresidential Energy Standards Overview, January 23, 2014
[Presentation](#) [WebEx Recording](#)

[WebEx Playback Help](#)

California Utilities

- LADWP - Los Angeles Department of Water & Power
- PG&E - Pacific Gas & Electric Company
- SMUD - Sacramento Municipal Utility District
- SDG&E - San Diego Gas & Electric Company
- SCE - Southern California Edison
- SoCal Gas - Southern California Gas Company

Other Resources

- Online Learning Center
- Energy Videos Center
- Blueprint Newsletter
- BECT - Building Energy Code Training Program (offered by Consol under contract)



Resources - Hotline

- Toll-free in California
- Open Monday through Friday
 - 8:00 am to noon, and
 - 1:00 pm to 4:30 pm
- Call at:
 - 1-800-772-3300 (In CA)
 - (916) 654-5106 (Outside CA)
- OR, e-mail at: Title24@energy.ca.gov



Resources - Listservers

- Main conduit for communicating with stakeholders
- Sign up at:
 - <http://www.energy.ca.gov/listservers/>
- Subscribe to the following Efficiency Lists:
 - Building Standards
 - Blueprint
 - Efficiency
- Respond to confirmation e-mail within 48 hours