



Decoding 2019 Alterations

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Let's Talk Residential HVAC



HELPING YOU PLAY YOUR CARDS RIGHT



Recording For Future Use

This session is
being recorded.

Last Decoding Talk...

 **Decoding** 2019 Alterations™
Let's Talk Nonresidential Indoor Lighting



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Tools ♣ Training ♣ Resources
to help you decode Title 24, Part 6 and Title 20



This program is funded by California utility customers and administered by Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E®), Southern California Edison Company (SCE), and Southern California Gas Company (SoCalGas®) under the auspices of the California Public Utilities Commission.



Who Are We?



Gina Rodda
Gabel Energy
gina@gabelenergy.com



BUILDING ENERGY ANALYSIS +
ENERGY CODE COMPLIANCE

Host: Gina Rodda

Gina Rodda, our host for the Decoding Talk series, is a Certified Energy Analyst (CEA) through CABEC, and LEED Accredited Professional (AP).

She is involved in providing residential and non-residential energy calculations for a variety of building types throughout California; an instructor of full day trainings; subject matter expert supporting future code development; aids the improvement to tools and resources supporting energy compliance through the private utility programs and the Energy Commission.

Gina has been in the energy modeling field since 1991.



Who Are We?



Bruce Cheney
Anchors Aweigh Energy
bruce@aae-hers.com

Co-Host: Bruce Cheney

Bruce Cheney is the founder and CEO of Anchors Aweigh Energy, an energy efficiency services company.

Mr. Cheney is a HERS rater, a BPI Building Analyst, and is active in ICC, IAPMO, and ASHRAE. Mr. Cheney has been actively working in the construction industry since his early teens except for a brief vacation with the US Navy.

Mr. Cheney has been working with the California Statewide Codes and Standards Team since 2013 as a subject matter expert on Title 24 Part 6 splitting his time between the classroom and job sites.

In his free time Mr. Cheney experiments with building off grid heat pumps for space conditioning using water as a refrigerant and home construction centered around rammed earth.

5



Decoding Residential HVAC Alterations

- ✦ Triggers associated with heating, ventilation and air conditioning (HVAC) changeouts, upgrades and fuel switching alterations
- ✦ HERS measures that apply to various scopes of work such as repairing an existing system or replacing an entire HVAC system, including ducting
- ✦ How remodeling various rooms, such as a kitchen or bathroom, may trigger ventilation requirements
- ✦ Documenting compliance via the Certificate of Compliance (CF1R) for all scenarios, and how to use the Project Status Report (PSR) to help manage the installation and verification documentation requirements (CF2R/CF3R)

6



Why?



HELPING YOU PLAY YOUR CARDS RIGHT



Handouts

2019 ENERGY CODE



20-24, Part 4
Triggers

Residential HVAC – Alterations

Split Systems and Packaged Systems

Change This (and nothing else)	Mandatory Requirements					Prescriptive Requirements			
	Thermostat Equipment \$100 / \$100/204	Cooling & Heating Leads \$100/204 Sublock Thermostat to EACS	HERS Verified Duct Leakage \$100/204	Air Filter \$100/204 MERV 8/9/10 N95/HEPA	HERS Verified Airflow Rate \$100/204 N/A	HERS Verified Fan Efficiency \$100/204 N/A	Duct Insulation \$100/204 R-2 for CE 11-14 R-6 for CE 1-10 R-10 for CE 2, 8-15 R-12 for CE 12-13	HERS Verified Refrigerant \$100/204 N/A	HERS Verified Refrigerant \$100/204 N/A
Replace belts, blower wheel fan, and/or electrical components	NO	NO	NO	NO	NO	NO	NO	NO	NO
Tap into existing HVAC and adding ≤ 40 ft new ducting	NO	NO	YES	YES	NO	NO	NO	YES	NO
Tap into Existing HVAC and adding ≤ 40 ft new ducting	NO	NO	YES	YES	NO	NO	NO	YES	NO
Replace all the ducting for existing HVAC	NO	NO	NO	YES	YES	YES	YES	YES	NO
Replace Air Handling Unit and Furnace	YES	NO	NO	YES	NO	NO	NO	NO	NO
Replace any refrigerant containing system components*	NO	YES	NO	YES	NO	Yes if HERS Refrigerant Charge required	NO	NO	YES
Replace a room heating / AC unit	YES	NO	NO	NO	NO	NO	NO	NO	NO
Replace all HVAC equipment but no new ductwork	YES	YES	NO	YES	NO	YES if AC Refrigerant Charge required	NO	NO	YES if AC
Add/Replace HVAC equipment and $\geq 75\%$ of ducting	YES	YES	YES	YES	YES if AC	YES if AC	YES if AC	YES	YES if AC

Note: * Replacing the blower wheel fan is considered a repair and does NOT trigger the Energy Code.
 • All new HVAC equipment must meet minimum Federal efficiency requirements.
 • Cooling fan motor is triggered if the low air-coupling system, suction line is replaced or repaired. Low-volt ≤ 1.5 in diameter must have 0.75" thick insulation.

2019 ENERGY CODE



20-24, Part 4
Fact Sheet

Residential and Nonresidential Just the Basics: HERS

Fact Sheet

Residential HVAC Alterations

Residential Heating & Cooling Equipment Minimum Efficiencies

Heating Efficiencies

Rated Input (Btu/h)	Minimum Efficiency (%)	
	AFUE	Thermal Efficiency
$\leq 225,000$	81%	—
$\leq 225,000$	80%	—
$\leq 225,000$	78%	—
$\leq 225,000$	—	80%
$\geq 225,000$	—	81%

Minimum Requirements: Title 20, Section 2.4.0.2.1

Minimum Heating Efficiency

Rating	Minimum Heating Efficiency
Rating Capacity	8.0 HSPF
Rating Capacity	8.2 HSPF
Rating Capacity	7.4 HSPF
Rating Capacity	7.4 HSPF
Rating Capacity	7.2 HSPF

that
shall
include
this
fact

starting
on

by
Constructed

Existing Low-Rise



Figure 2.4.0.2.1.1 Heating Equipment

If Home Energy Rating HERS Raters, who must be and equipment installation techniques and systems that such as HVAC systems, why these HERS measures, verification procedures, see Appendix C.

as designed and compliant can be installed and meet energy performance expected energy efficiency potential.

required, means meaning a HERS Home, HERS verification record will be listed on the facts for new buildings, report and will be listed on the

must be employees of the if entered in the builder's or new building, is the contractor without when installed or documentation prepared compliance.

Acceptance Test Technicians (ATT) are contractors trained via an ATTCP provider and may be able to provide verification for HERS measures associated with high-rise multifamily, institutional and nonresidential buildings. For the Energy Commission approves the ATTCP for HERS measure verification (as of September 2019, none have been approved).



Which Code Year Applies? Apply for permit...

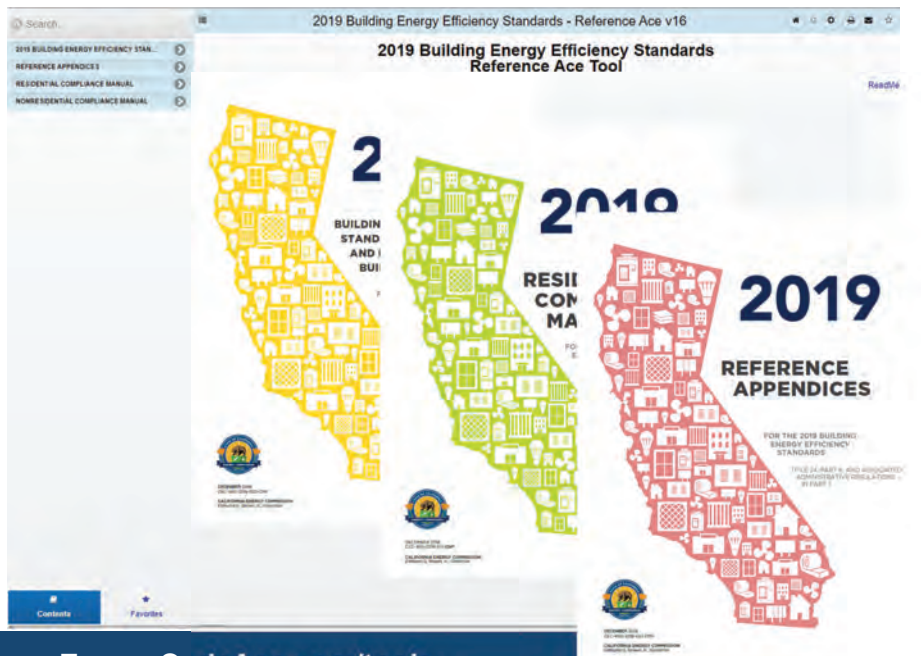
Jan. 2020- Dec. 2022



9



Helps you navigate the Standards using key word search capabilities, hyperlinked tables and related sections



EnergyCodeAce.com/tools

10



Defining the Difference

2019 ENERGY CODE
Triggers
 Residential
HVAC – Alterations

Split Systems and Packaged Systems

Change This (and nothing else!)	Mandatory Requirements							Prescriptive Requirements	
	Equipment Efficiency	Cooling & Heating Loads	HERS Verified Duct Leakage	Air Filter	HERS Verified Airflow	HERS Verified Fan Efficiency	Duct Insulation	HERS Verified Refrigerant	HERS Verified Fan Watt Draw
Replace split, blown air, and/or electrical components	NO	NO	NO	NO	NO	NO	NO	NO	NO
Tap into existing HVAC and adding 2" R new ducting	NO	NO	YES to verify existing HVAC ducting load if to an addition	NO	NO	NO	NO	YES	NO
Tap into existing HVAC and adding 2" R new ducting	NO	NO	YES	NO	NO	NO	NO	YES	NO
Replace all the ducting for existing HVAC	NO	NO	NO	YES	YES	YES	YES	YES	NO
Replace Air Handling Unit and Fanzone	YES	NO	NO	YES	NO	NO	NO	NO	NO
Replace any refrigerant containing system component*	NO	YES	NO	YES	NO	Yes if HERS Refrigerant Charge required	NO	NO	YES
Replace a split heating, A/C unit	YES	NO	NO	NO	NO	NO	NO	NO	NO
Replace all HVAC equipment but not new ductwork	YES	YES	NO	YES	NO	YES if HERS Refrigerant Charge required	NO	NO	YES if A/C
Add/replace HVAC equipment and 2" R of ducting	YES	YES	YES	YES	YES	YES if A/C	YES if A/C	YES	YES if A/C

Note: * Replacing the blower wheel fan is considered a repair and does NOT trigger the Energy Code.
 * All new HVAC equipment must meet minimum efficiency requirements.
 * Cooling fan wattage is triggered if the fan (or cooling system, section fan) is replaced or repaired. Lowering a 1" or diameter must have 2" R duct insulation.

EnergyCode.com Page 1 of 2

Mandatory Measures

- Min. Equipment Efficiency
- Thermostat
- Loads
- 2" MERV 13 filter
- HERS Duct Testing
- HERS Airflow
- HERS Fan Watt Draw

Prescriptive Compliance Approach

- Duct Insulation above mandatory min.
- HERS Refrigerant Charge

CF1R-ADD or CF1R-ALT

Performance Compliance Approach

Trade-offs between building systems.
i.e. A very efficient envelope system may allow flexibility with HVAC prescriptive requirements

CF1R-PRF

HERS Registration May Be Required

Let's Talk





Challenges



✦ Challenge A:

- ✦ Replacing Air Handler &/Or Replacing AC Condenser



✦ Challenge B:

- ✦ Replacing Ducting and/or Replacing/Adding Equipment



✦ Challenge C:

- ✦ IAQ



✦ Challenge D:

- ✦ Fuel Switching

13



Challenge A

Challenge A

Replacing Air Handler &/Or
Replacing/Adding AC
Condenser

14



Replacing Air Handler



Includes

- ✦ Air handler being replaced and ducting to remain as is

Does not Include

- ✦ Air handler being replaced and ducting to be replaced
- ✦ Air handler being replaced and ducting to remain as is and AC being replaced
- ✦ Air handler being replaced and ducting to remain as is and AC also being added
- ✦ Floor furnace being replaced with ducted system



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15



Steps to Compliance

Definition

- ✦ What is an altered space conditioning system per the Energy Code?

Trigger

- ✦ The scope of work triggers which requirements?
 - ✦ Equipment / Controls / HERS

HERS

- ✦ What is required by the triggered HERS measures?
 - ✦ Contractor
 - ✦ HERS Rate

Forms

- ✦ What forms will be required?
 - ✦ Do they need to be registered?

16



Definition

Definition What is an altered space conditioning system per the Energy Code?

What is an Altered Space-Conditioning System?
 It is alteration of one or complete replacement of the space conditioning system and 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 coils
 OR
 • Air handler
 Acceptable for Space to replacement space conditioning systems include:
 • Radiant gas
 • Localized condenser gas
 • The heat type of the system being replaced is gas, the replacement space conditioning system may be a heat pump.
 OR
 • Heat exchanger in air handler or furnace, if a single register does not register Title 24, Part 6 code requirements.

What is Entirely New versus Complete Replacement of a Space-Conditioning System?
 What all of the following are installed or replaced:
 • All the system heating/cooling components;
 • 75% new duct material.

Setback Thermostats: §110.2
 Only allowed on unoccupied cooling systems register.
 Installation of setback thermostats is not required for heating systems applications, unless the state heating system authority ducts is replaced, per Section 110.2(a) and 110.2(c).

Equipment Efficiency: §110.2
 All gas heating and cooling equipment installed in California homes is required to be the most efficient as follows: Compliance with ASHRAE 90.1-2010 (Energy Efficient Buildings) or the California Title 24, Part 6.1 code requirements.

Duct Sealing and Testing (HERS measure)
 Duct Sealing and Testing (HERS measure) is required for both altered and new replacement duct systems.
 • **Extension of Existing Ducts -40 ft:** The measured leakage must be 1.5% of system air handler air flow. This air handler is meeting the maximum 1% leakage. Consult your Building Department at (916) 227-1212.
 • **Altered Space Conditioning System:** The measured leakage must be < 1.0% of system air handler air flow. This air handler is meeting the maximum 1% leakage. Consult your Building Department at (916) 227-1212. In addition, the system must have a cooling load of at least 200 CHW per ton of measured cooling capacity or 1,200 CHW per ton of measured heating capacity for most duct load capacity systems and verified by the HERS Rater Refrigerant Charge verification and Penetration required for Climate Zone 2, 3 and 4.
 • **New/Replacement Space Conditioning System:** The Duct Sealing and Testing (HERS) measured total air leakage is 1.5% of the system air handler air flow. In addition, verification of Cooling Coil Airflow and the Air Duct Leakage measurement is required. For single register systems is automatically required for Climate Zone 2 and 3-4.
 • **Altered Ducts in Garage Space:** The measured leakage must be 1.5% of system air handler air flow. If measured leakage is not possible an alternative must be to have all penetrations sealed and verified through visual inspection and sealed tested by a HERS Rater.

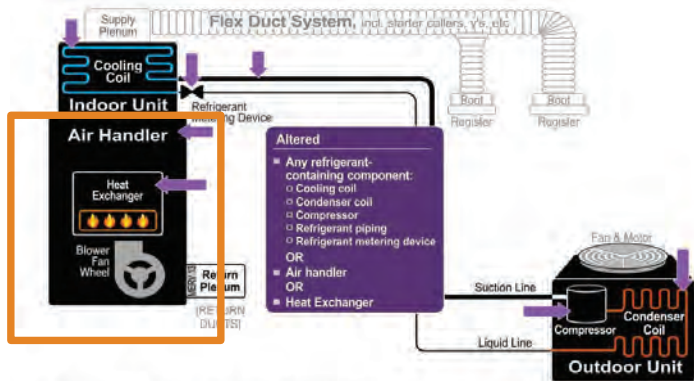


Figure 2: Altered Space-Conditioning System: §150.2(b)1E,F



Trigger

Trigger Scope of work

2019 ENERGY CODE
 Ace Resources Triggers
 Residential HVAC - Alterations
 Split System and Packaged Systems

Change This (and nothing else)	Mandatory Requirements	Prescriptive Requirements
Replace Air Handling Unit and Furnace	Equipment Efficiency §110.1 §110.2(a) Thermostat §110.2(c) §150.0(f) §150.2(b)1F Setback Thermostat or EMCS Cooling & Heating Loads §150.0(h) §150.2(a) exception 4-5 HERS Verified Duct Leakage? §150.2(b)1	Air Filter §150.0(m)12-13 §150.2(b)1C-D HERS Verified Airflow Rate² §150.0(m)13 §150.2(b)1C-F HERS Verified Fan Efficacy §150.0(m)13 §150.2(b)1 Duct Insulation §150.2(b)1D R-8 for CZ 11, 14-16 R-6 for CZ 1-10, 12-13 HERS Verified Refrigerant §150.1(c)7 §150.2(b)1F In CZ 2, 8-15

Replacing Air Handler Unit/Furnace



Equipment Efficiency

2019 ENERGY CODE
Ace Resources | **Climate Zone Quick Reference** | **Residential Heating & Cooling Equipment Minimum Efficiencies**

Gas- and Oil-Fired Central Furnaces – Minimum Heating Efficiencies

Appliance	Rated Input (Btuh)	Minimum Efficiency (%)	
		AFUE	Thermal Efficiency
Weatherized gas central furnaces with single phase electrical supply	<225,000	81%	—
Non-weatherized gas and oil central furnaces with single phase electrical supply	<225,000	80%	—
Weatherized oil central furnaces with single phase electrical supply	<225,000	78%	—
Non-weatherized oil central furnaces with single phase electrical supply	<225,000	83%	—
Gas central furnaces	≥225,000	—	80%
Oil central furnaces	≥225,000	—	81%

Table 4-1 of 2019 Residential Compliance Manual (based on the California Appliance Efficiency Regulations Title 20, Tables E-5 and E-6)

Heat Pump – Minimum Heating Efficiencies

Single-phase air source heat pumps:

Configuration	Size (Btuh)	Minimum Heating Efficiency
Packaged	<65,000 Cooling Capacity	8.0 HSPF
Split	<65,000 Cooling Capacity	8.2 HSPF
Space-constrained packaged	<65,000 Cooling Capacity	7.4 HSPF
Space-constrained split	<65,000 Cooling Capacity	7.4 HSPF
Small Duct High Velocity	<65,000 Cooling Capacity	7.2 HSPF

Note – HSPF: Heating Season Performance Factor

Adapted from Table 4-3 of 2019 Residential Compliance Manual (based on Title 20)



HERS

HERS → ✦ What is required by the triggered HERS measures?
 ✦ Contractor
 ✦ HERS Rate

Residential Energy Family and Low-Rise Multifamily Requirements

HERS Measures: Residential (based on Table RA2-1)	Mandatory	Prescriptive	Performance	Reference Appendices
DUCT MEASURES				
Duct Sealing: Verify approved duct system materials are utilized, and that duct leakage passes.	§150.0(m)11	N/A	N/A	RA3.1.4.3



RA3.1.4.3 Duct Leakage

Verification Description	User Application	Procedure(s)
Sealed and tested altered existing duct systems	Installer Testing HERS Rater Testing	RA3.1.4.3.1
Sealed and tested altered existing duct systems	Installer Testing HERS Rater Testing	RA3.1.4.3.4
Sealed and tested altered existing duct systems	Installer Testing and Inspection HERS Rater Testing and Verification	RA3.1.4.3.5 RA3.1.4.3.6 RA3.1.4.3.7



Use RA3.1.4.3.1: Diagnostic Duct Leakage from Fan Pressurization of Ducts: The objective of this procedure is for an installer to determine or a rater to verify the **total leakage of a new or altered duct system**.

Or RA3.1.4.3.4: Duct Leakage to Outside from Fan Pressurization of Ducts: The objective of this test is to **determine the amount of duct leakage to outside the air barrier for the conditioned space**.

If those fail, use

RA3.1.4.3.5: Sealing of All Accessible Leaks: For altered existing duct systems ... the **objective of this test is to verify that all accessible leaks are sealed**.

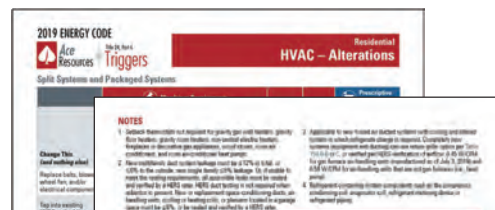
Along with RA3.1.4.3.6: Smoke-Test of Accessible-Duct Sealing: For altered existing ducts that fail the leakage tests, the **objective of the smoke test is to confirm that all accessible leaks have been sealed**.

Along with RA3.1.4.3.7: Visual Inspection of Accessible Duct Sealing: The objective of this inspection **in conjunction with the smoke test (RA3.1.4.3.6) is to confirm that all accessible leaks have been sealed**

21



Ducts in Garage



2 New multifamily duct system leakage must be $\leq 12\%$ in total, or $\leq 6\%$ to the outside; new single family $\leq 5\%$ leakage. Or, if unable to meet the sealing requirements, all accessible leaks must be sealed and verified by a HERS rater. HERS duct testing is not required when asbestos is present. New or replacement space-conditioning ducts, air-handling units, cooling or heating coils, or plenums located in a garage space must be $\leq 6\%$, or be sealed and verified by a HERS rater.

Change This (and nothing else)	Verification Mandatory Requirements Based on ASHRAE 62.2					
	WSPS (Single-Family)	WSPS (Multifamily)	As-Fabricated	As-Installed	Existing (As-Installed)	Existing (As-Installed)
Removal of ductwork	NO	NO	NO	NO	NO	NO
Adding ductwork and to existing space $\leq 2,000$ SF	YES	YES	YES	YES	If applicable	If applicable
Addition to home $\leq 2,000$ SF	YES	YES	If applicable	If applicable	If applicable	If applicable
Addition to home $> 2,000$ SF	NO	NO	If applicable	If applicable	If applicable	If applicable

22



Compliance Forms


Forms

✦ What forms will be required?

✦ Do they need to be registered?

Forms: Which & When

- 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



ALTERATIONS TO SPACE CONDITIONING SYSTEMS
CEC-CF1R-ALT-02-E (Revised 01/16)
 CALIFORNIA ENERGY COMMISSION
 CERTIFICATE OF COMPLIANCE
 Page 2 of 5

Space Conditioning Systems

Station: _____

Available to multiple space conditioning systems contained within a single dwelling unit. When multiple dwelling units must be documented, use one CF1R-ALT-02 document for each dwelling unit.

SI: _____ Date Prepared: _____

DI: _____ Building Type: _____

DD: _____ Dwelling Unit Name: _____

DU: _____ Dwelling Unit CFA (sq ft): _____

NS: _____ Number of Space Conditioning (SC) Systems in This Dwelling Unit: _____

09 Climate Zone: _____

B. Space Conditioning (SC) System Information

01	02	03	04	05	06	07	08	09	10
SC System ID/Name	SC System Description of this SC System (R#)	CFA served by this SC System (R#)	Is the SC system a ducted system?	Installing a refrigerant containing component?	Installing new SC system components?	Installing more than 20 feet of ducts?	Installing entirely new duct system?	Installing entirely new SC system?	Alteration Type:

C. Extension of Existing Duct System, Greater Than 40 Feet (Section 550.2(b)(1)(b))

11	12	13
SC System ID/Name	SC System Description of this SC System (R#)	Required New Duct & Vents

Required Documentation:
 CF2R-MCH-01 - Space Conditioning System
 Duct insulation requirement for the high portions of supply and return air plenums (R# (C2-1-10, 12 & 13) and R# (C2-11 & 14-15)).
 CF2R & CF3R-MCH-20-H - Duct Leakage Test
 Leakage rate compliance: ≤ 2% or ≤ 10% leakage by outside, or seal all accessible leaks.
 Exceptions:
 Existing duct systems constructed, insulated or sealed with asbestos are exempt from MCH-20 duct leakage testing requirements.

Registration Number: _____ Registration Date/Time: _____ HERS Provider: _____ January 2018
 CA Building Energy Efficiency Standards - 2018 Residential Compliance

23



Compliance Forms

Forms

✦ What forms will be required?

✦ Do they need to be registered?

Form	CF2R (Contractor)	Feature	CF3R (HERS Rater)
CF2R-MCH-01	Equipment, controls, duct insulation		
CF2R-MCH-20-H	Duct Testing		CF3R-MCH-20-H

- 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

24



CalCERTS.com

HOME SECURE HOME ABOUT TRAINING

HERS Training

Our training is accredited under American National Standards Institute and International Renewable Energy Congress Standards 14732:2012

HERS Rater Information | **Training with CalCERTS, Inc.**

Building Department Information | Contractor

Get Certified as a HERS Rater
We have on-going training for HERS Raters for all levels of certification.

Compliance FAQ
Check out our instructional videos to help answer your day-to-day questions.

PROJECT STATUS REPORT		CalCERTS, Inc. Effective 04/22/2020 19:49 (Page 1 of 2)		
GENERAL INFORMATION				
Energy Standards Code Year:	2019			
Project Name:	1 Story Example PV+Battery			
Project Type:	New Construction SFR			
Address:	1516 Ninth St			
City/State/Zip:	CalCERTSville / CA / 00000			
Enforcement Agency:	City of CalCERTSville			
Permit Number:	sadfid	Easy to Verify @ calcerts.com		
OVERALL STATUS:	NOT COMPLETE			
HERS VERIFIABLE MEASURES:	NOT COMPLETE			
CF1R INFORMATION - Certificate of Compliance (Document Lists Required Energy Features) ✓				
Certificate Type:	Compliance			
Registered Form:	CF1R-FRF-01			
Registered Date:	2020-01-02 09:29:50			
Registration Number:	220-P010000081A-000-000-000000-0000			
CF2R INFORMATION - Certificate of Installation (Documents the proper installation of required energy features) ●				
System	Form	Registered Date	Registration Number	
	CF2R-ENV-01		220-P010000081A-000-001-E01001A-0000	●
	CF2R-ENV-03		220-P010000081A-000-001-E03001A-0000	●
	CF2R-ENV-04		220-P010000081A-000-001-E04001A-0000	●
	CF2R-ENV-21		220-P010000081A-000-001-E21001A-0000 Johnny Builder (Builder One)	●
	CF2R-ENV-22		220-P010000081A-000-001-E22001A-0000	●
	CF2R-LTG-01		220-P010000081A-000-001-L01001A-0000	●
	CF2R-MCH-01		220-P010000081A-000-001-M01001A-0000 Johnny Builder (Builder One)	●
System 1: entire house	CF2R-MCH-20		220-P010000081A-000-001-M20001A-0000	●

CA Building Energy Efficiency Standards 2019 Residential Compliance HERS Provider: CalCERTS Inc. Dec 2019

25



Contractor: Accessing the CF2R's



2019 Code HOME CF1R CF2R CF3R \$

Pin Project Actions Activity Russell King, P.E.

Project Home (1516) / CF2R / LOT CF2R

Please select the CF2R to complete below.

THERE ARE NO DOCUMENTS READY FOR SIGNING

Lot ID	Lot Name	Address	Plan	Sample Group	CF1R Worksheet Status	Overall CF2R Status	Overall CF3R Status
1726981	Unit 1	1301 Bidwell St	1 Story Example PV+Battery		Complete	T24: Working [View ESR]	T24: Complete [View ESR]
						ESTR: Working [View ESR]	ESTR: Complete [View ESR]

[TAB VIEW] | [Previous Installers]

System ID	System	Tested Feature	Form Name	CF2R Status	Next Step	Document	Document Status	Documentation Author	Responsible Person
		Fenestration installation	CF2R-ENV-01	Not Started	Report Results		Claim Documents		
		Insulation installation	CF2R-ENV-03	Not Started	Report Results				
		Roofing-Radiant Barrier	CF2R-ENV-04	Not Started	Report Results				
		QI-Framing Stage	CF2R-ENV-21	Not Started	Report Results				
		QI-Insulation installation	CF2R-ENV-22	Not Started	Report Results				
	Lighting		CF2R-LTG-01	Complete				Signed	Hugo J Schmidt: (CalCERTS, Inc.) Johnny Builder (Builder One)

[LINK TO Data Entry] | [SHOW XML Errors]

26



CHEERS.org

CHEERS Getting Started ▾

Your source for California energy code documentation

CHEERS is an online verification platform where building industry professionals register projects for California energy code compliance

GET STARTED

CHEERS REGISTRY PROJECT STATUS REPORT

PROJECT SUMMARY

Project Name: System 2
 Address: 8001 D St #200
 City, State, Zip: Sacramento, CA 95811
 Building Department: Sacramento, City of
 Permit Number: 18-2-4230
 Building Energy Code: 2016, Standards

HERS VERIFIABLE MEASURES **COMPLETE** ✓

ENERGY CODE COMPLIANCE **COMPLETE** ✓

CERTIFICATE OF COMPLIANCE (CFIR)

DATE	DOCUMENT	TITLE	REGISTRATION NUMBER	STATUS
04/02/2020	CFIR-ALT-02-E	Residential HVAC Alterations	420-A020036946A-000-000-0000000-0000	✓

(00) changed from "R" to "E".

CERTIFICATE OF INSTALLATION (CF2R)

DATE	DOCUMENT	TITLE	REGISTRATION NUMBER	STATUS
04/02/2020	CF2R-MCH-01b-E	HVAC, Ducts and Fans	420-A020036946A-000-001-M01001A-0000	✓
System 1				
04/02/2020	CF2R-MCH-204-H	Duct Leakage	420-A020036946A-000-001-M20002A-0000	✓
04/02/2020	CF2R-MCH-23a-H	Airflow Rate	420-A020036946A-000-001-M23003A-0000	✓
04/02/2020	CF2R-MCH-25b-H	Refrigerant Charge	420-A020036946A-000-001-M25004A-0000	✓
System 1				
04/02/2020	CF3R-MCH-204-H	Duct Leakage	420-A020036946A-000-001-M20002A-M20A	✓
04/02/2020	CF3R-MCH-23a-H	Airflow Rate	420-A020036946A-000-001-M23003A-M23A	✓
04/02/2020	CF3R-MCH-25b-H	Refrigerant Charge	420-A020036946A-000-001-M25004A-M25A	✓

NOTE: This compliance summary report was generated by a registration platform powered by CHEERS using information that has been uploaded to the registration platform by third parties that are not affiliated or related to CHEERS. Therefore, CHEERS is not responsible for, and cannot guarantee, the accuracy or completeness of the information contained in this summary.

Page 1 of 1



Contractor: Accessing the CF2R's



CHEERS Sites Sample Groups Communities Gina R. 🗨️

155 Jackson Rd. Download docs Send docs

CF2R - Installation

Envelope Lighting **Mechanical** Plumbing Photovoltaic

ENV01 Not Started LTG01 Not Started MCH01 Not Started PLB02 Not Started PVB01 Not Started

ENV03 Not Started MCH31 Not Started

MCH32 Not Started

CFIR - Compliance

Performance

PRJ-01 Passed



Replacing AC Condenser



Includes

- AC being replaced and air/handler ducting to remain as is

Does not Include

- AC being replaced and ducting to be replaced
- AC being replaced, Air handler being replaced and ducting to remain as is
- AC being added



HELPING YOU PLAY YOUR CARDS RIGHT



Definition

Definition

What is an altered space conditioning system per the Energy Code?

What is an Altered Space-Conditioning System?
 A replacement of one or more of the following components in an existing system is considered an Altered Space-Conditioning System:

- Any refrigerant-containing component, including:
 - Cooling coil
 - Condenser coil
 - Compressor
 - Refrigerant piping
 - Refrigerant metering device
 - Outdoor condensing coils
- Air handler
- Heat exchanger
- Blower fan wheel
- Local exhaust fan
- Local exhaust combustion gas
- Local exhaust combustion gas
- Local exhaust combustion gas

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% or more duct material

Setback Thermostats: §110.2
 Only altered or newly installed cooling systems require setback thermostats. Heating systems require setback thermostats unless the public health officer determines they are not required, per Section 150.2(b) and 150.2(c).

Equipment Efficiency: §110.2
 Most heating and cooling equipment installed in California homes is required to meet the National Appliance Energy Conservation Act (NAECA) and the California Home Energy Performance (CHPEP) standards.

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

- Expansion of Existing Ducts - 40 ft:** The measured leakage must be 1.0% or less of the system air flow. (This air flow is determined by measuring the measured 175 leakage. Consult your Building Department at Section 150.2(b)(1)(A).)
- Altered Space Conditioning System:** The measured leakage must be 1.0% or less of the system air flow. (This air flow is determined by measuring the measured 175 leakage. Consult your Building Department at Section 150.2(b)(1)(A).)
- Altered Ducts in Garage Spaces:** The measured leakage must be 1.0% of the system air flow. If measured leakage is not possible an alternative method to test all penetrations must be used and all ducts through tested penetrations and sealed tested by a certified HERS Rater.

New/Replacement Space Conditioning System: The Duct Sealing and Testing (HERS) measured leak measurement is leakage (up to 75% of the system air flow) in order to address penetrations of Existing Gas Appliances and for Step-Down (HERS) measurement is required. Refer Section 150.2(b)(1)(A) and 150.2(b)(1)(B).

Altered Ducts in Garage Spaces: The measured leakage must be 1.0% of the system air flow. If measured leakage is not possible an alternative method to test all penetrations must be used and all ducts through tested penetrations and sealed tested by a certified HERS Rater.

EnergyGals.com Page 1 of 4

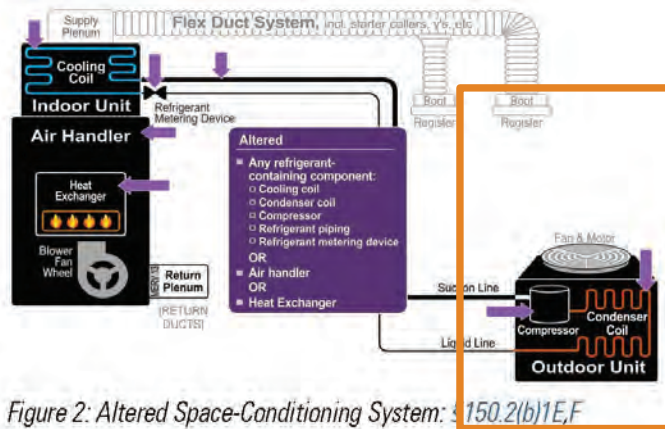
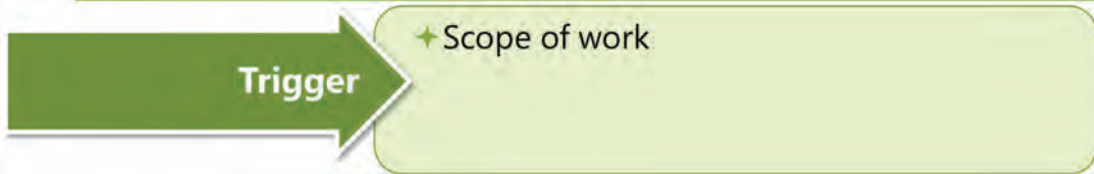


Figure 2: Altered Space-Conditioning System: §150.2(b)1E,F



Trigger



2019 ENERGY CODE
 Ace Resources
 Triggers
 Residential
 HVAC - Alterations

Split Systems and Packaged Systems

Change This (and nothing else)
 Replace any refrigerant containing system components¹

EnergyJobs.com

Replacing AC

	Mandatory Requirements					Prescriptive Requirements			
Equipment Efficiency §110.1 §110.2(a)	Thermostat §110.2(c) §150.0(i) §150.2(b)1F Setback Thermostat or EMCS	Cooling & Heating Loads §150.0(h) §150.2(a) exception 4-5	HERS Verified Duct Leakage ² §150.2(b)1	Air Filter §150.0(m)12-13 §150.2(b)1C-D	HERS Verified Airflow Rate ² §150.0(m)13 §150.2(b)1C-F	HERS Verified Fan Efficacy §150.0(m)13 §150.2(b)1	Duct Insulation §150.2(b)1D R-8 for CZ 11, 14-16 R-6 for CZ 1-10, 12-13	HERS Verified Refrigerant §150.1(c)7 §150.2(b)1F In CZ 2, 8-15	
na	YES	na	YES	na	Yes if HERS Refrigerant Charge required	na	na	YES	



Thermostat

Setback Thermostats: §110.2

What is an Altered Space-Conditioning System?
 An alteration to an existing space-conditioning system (one or more of the following) is required if it is installed or repaired, is replaced or replaced in-kind, or is replaced in-kind with a different type of system.

- Any refrigerant-containing component, a:
 - Condenser coil
 - Compressor
 - Expansion valve
 - Refrigerant

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
 Major heating and cooling equipment installed in California-based jurisdictions shall be Energy Star certified or meet the minimum efficiency requirements for the California Energy Efficiency Standards (CES).

Duct Sealing and Testing (HERS measure)
 Duct Sealing and Testing (HERS) is required for both altered and new/replacement cooling systems. The measured leakage must be 0.5% of the system air leakage or less. If measured leakage is greater than 0.5%, the system must be sealed to meet the 0.5% requirement. In addition, the system must have a cooling load capacity of 200 CFM per ton of nominal cooling capacity for small duct high velocity systems and worked by the HERS Rater Refrigerant Charge and is required for Prescriptive required for Climate Zones 2 and 3.

EnergyJobs.com

110.2(c) Thermostats.

- All heating or cooling systems not controlled by a central energy management control system (EMCS) shall have a setback thermostat.

- Setback Capabilities. All thermostats shall have a clock mechanism that allows the building occupant to program the temperature setpoints for at least four periods within 24 hours. Thermostats for heat pumps shall meet the requirements of Section 110.2(b).

- EXCEPTION to Section 110.2(c): 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.



Equipment Efficiency

2019 ENERGY CODE
Ace Resources | **Climate Zone Quick Reference** | **Residential Heating & Cooling Equipment Minimum Efficiencies**

Gas- and Oil-Fired Central Furnaces – Minimum Heating Efficiencies

(Smaller) Central Air Conditioners and Heat Pumps — Minimum Cooling Efficiencies

Appliance	Type	Size (Btu/h)	SEER Effective 1/1/2015	EER Effective 1/1/2015
Outdoor Unit (Indoor Furnace) Central Air Conditioners	Split System	<45,000	14.0	12.2
		≥45,000 and <65,000	14.0	11.7
Packaged Unit (All Outdoors) Central Air Source Heat Pumps	Single Package	<65,000	14.0	11.0
		<65,000	14.0	NR
Space Constrained Air Conditioner	Split System	<65,000	12.0	NR
	Single Package	<65,000	12.0	NR
Space Constrained Heat Pump	Split System	<65,000	12.0	NR
	Single Package	<65,000	12.0	NR
Small Duct, High Velocity Air Conditioner	All	<65,000	12.0	NR
Small Duct, High Velocity Heat Pump	All	<65,000	12.0	NR

Adapted from Table 4-6 from 2019 Residential Compliance Manual (based on Title 20, Table C-3 and Federal Appliance Standards)

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 Page 1 of 2



HERS

HERS → What is required by the triggered HERS measures?

- Contractor
- HERS Rate

Residential Energy Penalty and Low-Risk Mitigation Requirements

HERS Measures: Residential (based on Table RA2-1)	Mandatory	Prescriptive	Performance	Reference Appendices
DUCT MEASURES				
Duct Sealing: Verify approved duct system materials are utilized, and that duct leakage passes.	§150.0(m)11	N/A	N/A	RA3.1.4.3
HEATING & COOLING EQUIPMENT MEASURES				
Cooling System Airflow: System airflow greater than or equal to a specified criterion.	§150.0(m)13	Exception to §150.1(c)7Aib Exception 2 to §150.2(b)Fia	Credit for exceeding min. Res ACM 2.4.5.2	RA3.3
Refrigerant Charge/Fault Indicator Display: Air-cooled air conditioners and air-source heat pumps diagnostically tested to verify that the system has the correct refrigerant charge. Fault Indicator Display can be installed as an alternative.	N/A	§150.1(c)7A CZ 2.8-15	Credit in CZ 1.3-7.16 Res ACM 2.4.5.1	RA1.2 RA3.2 RA3.3 RA3.4.2



RA3.3 Airflow



Use RA3.3.3.1.3 System Airflow Rate Measurement Using *Powered or Traditional* Flow Capture Hood: The system airflow measurement shall be performed using the following procedures;

- **all registers shall be fully open, and the air filter shall be installed.**
- Turn on the system fan at the cooling speed and measure the airflow at the return grille(s) with a calibrated powered flow hood to determine the total system return airflow.
- *Traditional:* For multiple return systems, the total system return airflow (Qah, cfm) shall be the sum of the airflow measurements at each of the system's return grilles.

If those fail, use

35



RA3.3 Airflow



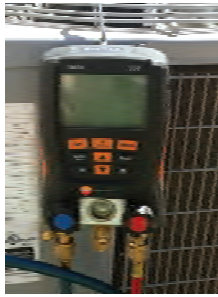
RA3.3.3.1.5 Remedial Actions: The installer shall attempt to correct non-compliant system airflow by performing the following remedial actions:

- a) Check to determine that the air filter media is clean. If the air filter media is dirty, then replace it with clean filter media.
- b) Open all registers and dampers and remove any obstructions.
- c) Replace crushed, blocked or restricted ducts if possible.
- d) Check to determine that the evaporator coil is clean, or that there are no obstructions to airflow through the evaporator coil. If the evaporator coil is dirty or blocked with debris, if possible, clean the evaporator coil using a method approved by the manufacturer.
- e) Set the air handler fan to high speed for cooling, and ensure that the blower wheel and motor are operating properly, within manufacturer's specifications.
- f) Check to determine whether the return duct system or return filter grille is sized too small for the installed system. If the return duct or return grille is sized too small, if possible, perform applicable alterations work on the return duct system or return grille in order to improve the system airflow rate.

36



RA3.2 Refrigerant Charge



Altered AC in CZ 2, 8-15



Performance **credit** in CZ 1,3-7, 16



Potential **penalty** in CZ 2, 8-15

Standard Charge RA3.2.2	Weigh-In Charge RA3.2.3	Charge Indicator Display RA3.2.2.6
<ul style="list-style-type: none"> Verification of minimum system airflow rate across the cooling coil and that metering device is operating properly. <ul style="list-style-type: none"> Outdoor air temperature is 55°F or above. Be able to maintain indoor return air temperature above 70°F 	<ul style="list-style-type: none"> MAY be used as an alternative to the Standard Charge <ul style="list-style-type: none"> SHALL be used when the outdoor air temperature is below 55°F and for mini splits year round HERS raters SHALL observe HVAC installer JA5 (Wifi) certified thermostat to be installed 	<ul style="list-style-type: none"> Provide real-time information to the building occupant about the status of: <ul style="list-style-type: none"> System refrigerant charge; Metering device; System airflow.



Compliance Forms

Forms

What forms will be required?

Do they need to be registered?

Forms: Which & When

In addition to a permit, a permit HERS rater will require the following:

- CFIR-ALT-02-E
- Completed and signed by the installing contractor
- Must be registered with a HERS Provider prior to permit application

CFIR-ALT-02-E: Certificate of Compliance for Space Conditioning Systems, Ducts and Pipes

- Completed and signed by the installing contractor
- Available for final inspection by building department
- Must be registered with a HERS Provider prior to final inspection

CFIR-MCH-20-H: Certificate of Installation for Duct 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

CFIR-MCH-20-H: Certificate of Installation for Duct 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

ALTERATIONS TO SPACE CONDITIONING SYSTEMS

CFR-CALIF-55.6 (Revised 01/16) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE

Alterations to Space Conditioning Systems

Project Name: _____ Site Address: _____

Permit Number: _____

A. General Information

CFIR-ALT-02 is applicable to multiple space conditioning systems contained within a single dwelling unit. When multiple dwelling units must be documented, use one CFIR-ALT-02 document for each dwelling unit.

01	Project Name:	02	Date Prepared:
04	Building Type:	05	Dwelling Unit Name:
06	Dwelling Unit CFA (sq. ft.):	07	Number of Space Conditioning (SC) Systems in this Dwelling Unit:
08	Number of Space Conditioning (SC) Systems in this Dwelling Unit:	09	Alteration Type:

C. Extension of Existing Duct System, Greater Than 40 Feet (Section 55.6(b)(1)(D))

SC System	Description of Area Served	Required New Duct	Required R-Value
01	SC System <td>Required <td>R-Value </td></td>	Required <td>R-Value </td>	R-Value
02	Description of Area Served <td>Required <td>R-Value </td></td>	Required <td>R-Value </td>	R-Value

Required Documentation:

CFIR-MCH-02-E - Space Conditioning Agreements

Duct insulation requirement for the high portions of supply and return air plenums (per R-11, R-12 & R-13) and R-14 (R-11 & R-13).

CFIR & CFIR-MCH-20-H - Duct Leakage Test

Leakage rate compliance: ≤ 2% or ≤ 10% leakage to outside, or seal all accessible leaks

EXEMPTIONS:

Existing duct systems constructed, insulated or sealed with asbestos are exempt from MCH-20 duct leakage testing requirements.

Registration Number: _____ Registration Date/Time: _____ HERS Provider: _____ January 2018

CA Building Energy Efficiency Standards - 2018 Residential Compliance



Compliance Forms



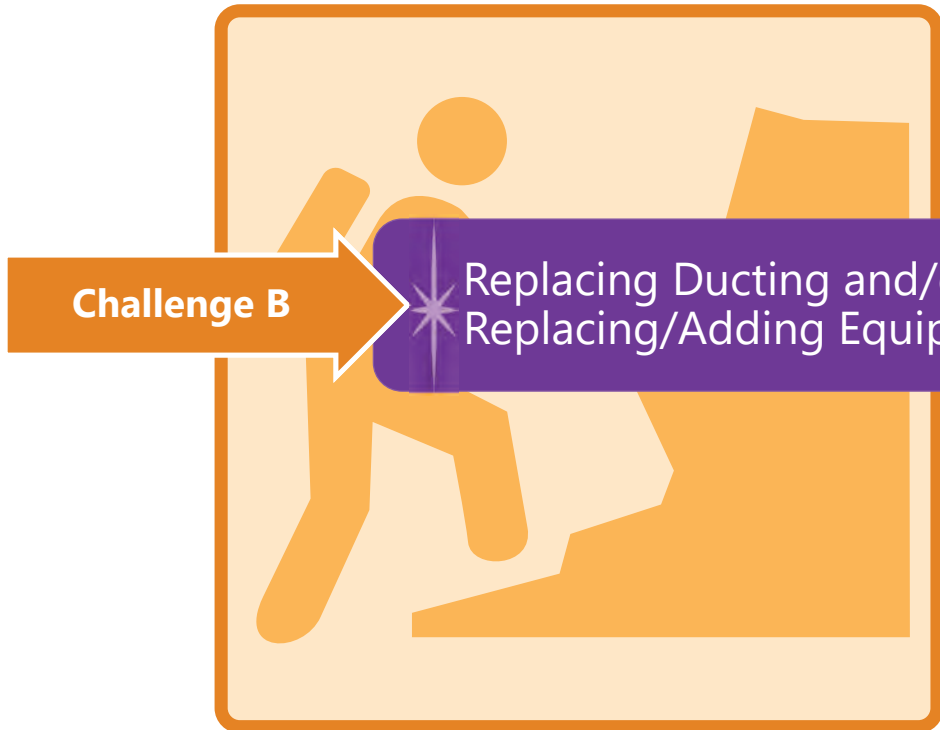
✦ What forms will be required?
 ✦ Do they need to be registered?

Form	CF2R (Contractor)	Feature	CF3R (HERS Rater)
	CF2R-MCH-01	Equipment, controls, duct insulation	
	CF2R-MCH-20-H	Duct Testing	CF3R-MCH-20-H
	CF2R-MCH-23-H	Airflow	CF3R-MCH-23-H
	CF2R-MCH-25-H	Refrigerant Charge	CF3R-MCH-25-H

	<ul style="list-style-type: none"> - CF3R-MCH-23*-H: Certificate of Verification for Airflow Rate <ul style="list-style-type: none"> - 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 <ul style="list-style-type: none"> - 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
--	--



Challenge B



✦ Replacing Ducting and/or Replacing/Adding Equipment



Replacing Ducting



Includes

- ✦ Replacing ducting, but the air handler and AC remains

Does not Include

- ✦ Ducting to be replaced and AC being replaced
- ✦ Ducting to be replaced and Air Handler replaced
- ✦ Ducting to be replaced and Air Handler/AC replaced
- ✦ Going to ductless system



HELPING YOU PLAY YOUR CARDS RIGHT



Definition

Definition

- ✦ What is an altered space conditioning system per the Energy Code?

What is an Altered Space-Conditioning System?
 It is a replacement of one or more of the following components in an existing or installed air conditioning system:
 • Air handler
 • Cooling coil
 • Condenser coil
 • Compressor
 • Refrigerant piping
 • Air handler/condenser coils
 • Outdoor condenser coils

What is Entirely New versus Complete Replacement of a Space-Conditioning System?
 What all of the following are included or replaced:
 • All the system heating/cooling components
 • 75% new duct material

Setback Thermostats: \$110.2
 Only allowed if new replacement cooling system triggers installation of setback thermostat. If not allowed for heating system-only replacements, unless the entire heating system is being replaced, per Section 150.4(a) and 150.5(c).

Equipment Efficiency: \$110.2
 Most heating and cooling equipment installed in California homes is required by the National Appliance Energy Conservation Act (NAECA) and the California Building Energy Efficiency (CBEEM) (2008-09).

Duct Sealing and Testing (HERS measure)
 Duct Sealing and Testing (HERS) measure is required for both altered duct systems and new replacement duct systems.
 • **Expansion of Existing Ducts -40 ft:** The measured leakage must be 4.0% of system air handler air flow. (This air allowance is waiving the maximum 17% leakage. Consult your Building Department at Section 150.2(b)(2)(A).)
 • **Altered Space Conditioning System:** The measured leakage must be 4.0% of system air handler air flow. (This air allowance is waiving the maximum 17% leakage. Consult your Building Department at Section 150.2(b)(2)(B). In addition, the system must have a cooling coil airflow >300 CFM per ton of nominal cooling capacity or 7,200 CFM per ton of nominal cooling capacity for small duct high velocity systems and tested by the HERS-Rater Refrigerant Charge and Leakage or Penetration required for Climate Zone 2 (2008-09).

New/Replacement Space Conditioning System: The Duct Sealing and Testing (HERS) measured total ductwork leakage (up to 75% of the system air handler air flow) to achieve certification of Cooling and Heating will be 40% Duct (HERS) measured is required. Refrigerant Charge, applicable to Penetration required for Climate Zone 2 and 3.15.

Altered Ducts or Change Space: The measured leakage must be 4.0% of system air handler air flow. If measured leakage is not available an alternative method for low air permeability leaks, such as air seal through visual inspection and sealed tested by a HERS-Rater Rater.

EnergyCalc.com Page 1 of 4

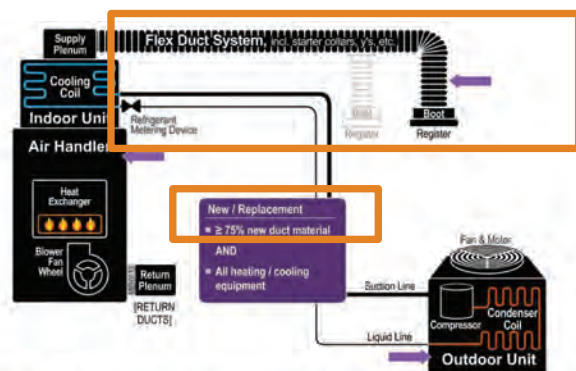
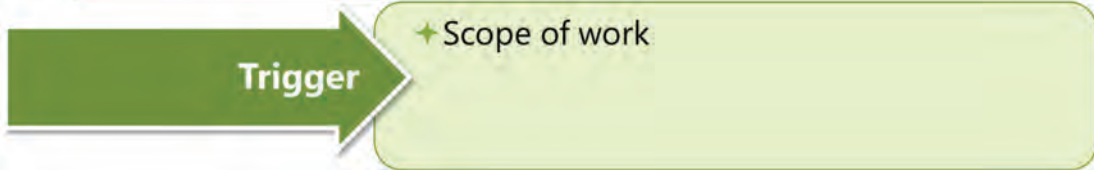


Figure 3: Entirely New or Complete Replacement Space-Conditioning System: \$150.2(b)1C



Trigger



2019 ENERGY CODE
 Ace Resources Triggers
 Residential HVAC - Alterations

Split Systems and Packaged Systems

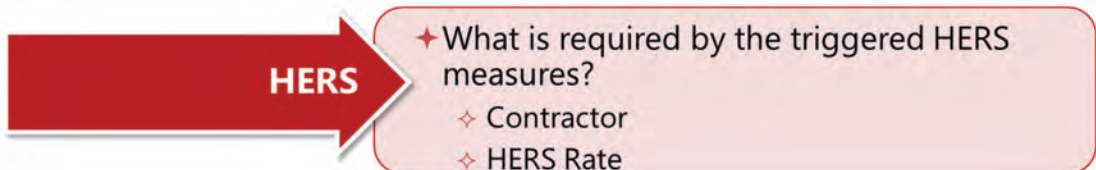
Change This (and nothing else) Replace all the ducting for existing HVAC.

✦ Replacing $\geq 75\%$ of Ducting

	Mandatory Requirements						Prescriptive Requirements	
Equipment Efficiency §110.1 §110.2(a)	Thermostat §110.2(c) §150.0(f) §150.2(b)1F Setback Thermostat or EMCS	Cooling & Heating Loads §150.0(h) §150.2(a) exception 4-5	HERS Verified Duct Leakage ² §150.2(b)1	Air Filter §150.0(m)12-13 §150.2(b)1C-D	HERS Verified Airflow Rate ² §150.0(m)13 §150.2(b)1C-F	HERS Verified Fan Efficacy §150.0(m)13 §150.2(b)1	Duct Insulation §150.2(b)1D R-8 for CZ 11, 14-16 R-6 for CZ 1-10, 12-13	HERS Verified Refrigerant §150.1(c)7 §150.2(b)1F In CZ 2, 8-15
no	no	no	YES	YES	YES	YES	no	



HERS



HERS Measures: Residential (based on Table RA2-1)	Mandatory	Prescriptive	Performance	Reference Appendices
DUCT MEASURES				
Duct Sealing: Verify approved duct system materials are utilized, and that duct leakage passes.	§150.0(m)11	N/A	N/A	RA3.1.4.3
Air Filter Device: Confirming the air filter devices conform §150.0(m)12.	§150.0(m)13	N/A	N/A	RA3.1.4.5
HEATING & COOLING EQUIPMENT MEASURES				
Cooling System Airflow: System airflow greater than or equal to a specified criterion.	§150.0(m)13	Exception to §150.1(c)7A1b Exception 2 to §150.2(b)1F1a	Credit for exceeding min. Res ACM 2.4.5.2	RA3.3
Cooling System Air-Handling Fan Efficacy: Fan efficacy (W/cfm) less than or equal to a specified criterion.	§150.0(m)13	N/A	Credit for exceeding min. Res ACM 2.4.5.2	RA3.3



RA3.1.4.5 Air Filter

Verification shall consist of a visual inspection to confirm that the air filter devices conform to the requirements given in Section [150.0\(m\)12](#).



150.0(m)12. Air Filtration.

- **Mechanical space conditioning systems that supply air to an occupiable space through ductwork exceeding 10 ft (3 m) in length.**
- **Mechanical supply-only ventilation systems that provide [outside air](#) to an occupiable space.**
- The **supply side of mechanical balanced ventilation systems**, including heat recovery ventilation systems, and energy recovery ventilation systems that provide outside air to an occupiable space.

45



RA3.1.4.5 Air Filter



B. System Design and Installation.

- The system shall be designed to ensure that all **recirculated air** and all **outdoor air** supplied to the **occupiable space is filtered before passing through any system's thermal conditioning components.**
- All systems shall be designed to accommodate the clean-filter pressure drop imposed by the system air filter(s). **The design airflow rate, and maximum allowable clean-filter pressure drop at the design airflow rate applicable to each air filter shall be determined and reported on labels**

46



RA3.1.4.5 Air Filter



B. System Design and Installation.

- Nominal **two-inch minimum depth filter(s)** shall be sized by the system designer, **or**
- Nominal one-inch minimum depth filter(s) shall be allowed if the filter(s) are sized according to Equation 150.0-A, based on a maximum face velocity of 150 ft per minute, and according to the maximum allowable clean-filter pressure drop specified in Section 150.0(m)12Dii.



C. Air Filter Efficiency.

The system shall be provided with air filters having a **designated efficiency equal to or greater than MERV 13** when tested in accordance with [ASHRAE Standard 52.2](#), or a [particle size efficiency](#) rating equal to or greater than 50% in the 0.30-1.0 µm range and equal to or greater than 85% in the 1.0-3.0 µm range when tested in accordance with [AHRl Standard 680](#).



RA3.3 Fan Efficacy

2019 ENERGY CODE
Air Resources
HVAC - Alterations
Split System and Packaged Systems

NOTES

- Before a permit is issued for any project, the permit applicant shall provide a copy of the permit application to the permittee for review and approval.
- For all projects, the permittee shall provide a copy of the permit application to the permittee for review and approval.
- For all projects, the permittee shall provide a copy of the permit application to the permittee for review and approval.
- For all projects, the permittee shall provide a copy of the permit application to the permittee for review and approval.

3 Applicable to new forced air ducted systems with cooling and altered system in which refrigerate charge is required. Completely new systems (equipment and ducting) can use return grille option per Table 150.0-B or C, or verified per HERS verification of airflow: 0.45 W/CFM for gas furnace air-handling units (manufactured as of July 3, 2019) and 0.58 W/CFM for air-handling units that are not gas furnaces (i.e., heat pump).

DEPT. OF PERMITS
SERIES
SERIAL 2919A19419
DATE OF MANUFACTURE JUL 2019

TABLE 150.0-B: Return Duct Sizing for Single Return Duct Systems

Return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees, one bend shall be a metal elbow.

Return grille devices shall be labeled in accordance with the requirements in Section 150.0(m)12Biv to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of 25 Pa (0.1 inches water) for the air filter media as rated in accordance with AHRl Standard 680 for the design airflow rate for the return grille.

System Nominal Cooling Capacity (Ton)*	Return Duct Minimum Nominal Diameter (inch)	Minimum Total Return Filter Grille Nominal Area (inch ²)
1.5	16	500
2.0	18	600
2.5	20	800

*Not applicable to systems with nominal cooling capacity greater than 2.5 tons or less than 1.5 ton

TABLE 150.0-C: Return Duct Sizing for Multiple Return Duct Systems

Each return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees, one bend shall be a metal elbow.

Return grille devices shall be labeled in accordance with the requirements in Section 150.0(m)12Biv to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of 25 Pa (0.1 inches water) for the air filter when tested using ASHRAE Standard 52.2, or as rated in accordance with AHRl Standard 680 for the design airflow rate for the return grille.

System Nominal Cooling Capacity (Ton)*	Return Duct 1 Minimum Nominal Diameter (inch)	Return Duct 2 Minimum Nominal Diameter (inch)	Minimum Total Return Filter Grille Nominal Area (inch ²)
1.5	12	10	500
2.0	14	12	600
2.5	14	14	800
3.0	16	14	900
3.5	16	16	1000
4.0	18	18	1200
5.0	20	20	1500

*Not applicable to systems with nominal cooling capacity greater than 5.0 tons or less than 1.5 tons.



Compliance Forms



- What forms will be required?
- Do they need to be registered?

Forms: Which & When

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

- CF1R-ALT-01
- Completed and signed by the installing contractor
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-H
- Certificate of Installation for Space Conditioning Systems, Ducts and Fans
- Completed and signed by the contractor
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-H
- Certificate of Installation for Space Conditioning Systems, Ducts and Fans
- Completed and signed by the contractor
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-H
- Certificate of Installation for Space Conditioning Systems, Ducts and Fans
- Completed and signed by the contractor
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-H
- Certificate of Installation for Space Conditioning Systems, Ducts and Fans
- Completed and signed by the contractor
- Must be registered with a HERS Provider prior to permit application

ALTERATIONS TO SPACE CONDITIONING SYSTEMS

DEC-2017/04/04 (Revised 01/16) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE

Alterations to Space Conditioning Systems

Form No. CF1R-ALT-02-E (Page 1 of 5)

A. General Information

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

01 Project Name: _____ 02 Date Prepared: _____

03 Building Type: _____ 04 Dwelling Unit Name: _____

05 Dwelling Unit CEA (sq ft): _____ 06 Number of Space Conditioning (SC) Systems in This Dwelling Unit: _____

07 _____ 08 _____ 09 _____ 10 _____

Item	04	05	06	07	08	09	10
is the SC system a ducted system?							
installing a refrigerant containing component?							
installing new SC system components?							
installing more than 20 feet of ducts?							
installing entirely new duct system?							
installing entirely new SC system?							
Alteration Type:							

C. Extension of Existing Duct System, Greater Than 40 Feet (Section 150.2(b)(1)(b))

SC System #	SC System Description of Area Served	Required New Duct System
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

Required Documentation:
CF1R-MCH-01 - Space Conditioning System
Duct insulation requirement for the high portions of supply and return air plenums (R4 (R2 + 10), L2 & L3) and R4 (R2 + 11 & 14-16).
CF1R & CF1R-MCH-20-H - Duct Leakage Test
Leakage rate compliance: ≤ 2.5% or ≤ 1.0% leakage to outside, or seal all accessible leaks.
Exceptions:
Existing duct systems constructed, insulated or sealed with asbestos are exempt from MCH-20 duct leakage testing requirements.

Registration Number: _____ Registration Date/Time: _____ HERS Provider: _____ January 2018
CA Building Energy Efficiency Standards - 2018 Residential Compliance



Compliance Forms



- What forms will be required?
- Do they need to be registered?

Form	CF2R (Contractor)	Feature	CF3R (HERS Rater)
CF2R-MCH-01		Equipment, controls, duct insulation	
CF2R-MCH-20-H		Duct Testing	CF3R-MCH-20-H
Use CF2R-MCH-01		Air Filter	
CF2R-MCH-22-H		Fan Efficacy	CF3R-MCH-22-H
CF2R-MCH-23-H		Airflow	CF3R-MCH-23-H
Using Table 150.0-C or D instead of Fan Efficacy HERS test			
CF2R-MCH-28-H		Return Grille and Filter Design Table	CF3R-MCH-28-H



Adding Ducting



Adding ≤ 40 ft of ducting, but not touching Air Handler/ AC IS NOT A CODE TRIGGER though the new ducting will need to meet duct insulation requirements

Includes

- ✦ Adding >40 ft of ducting, but the Air Handler/AC remains

Does not Include

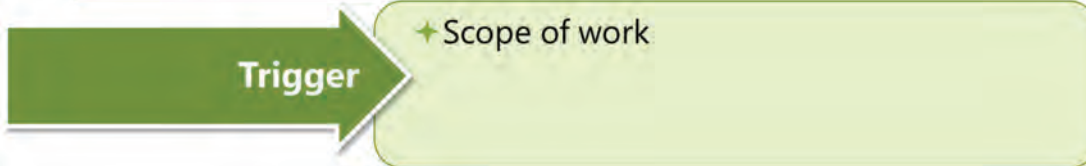
- ✦ Ducting to be replaced and Air Handler / AC remain
- ✦ Ducting to be replaced and Air Handler OR AC being replaced
- ✦ Ducting to be replaced and Air Handler / AC replaced
- ✦ Going to ductless system



HELPING YOU PLAY YOUR CARDS RIGHT



Trigger



✦ Adding Ducting

2019 ENERGY CODE
 Ace Resources Triggers
 HVAC - Alterations

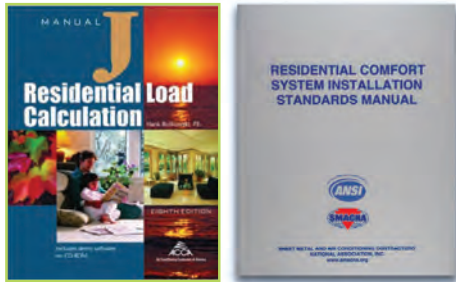
Split System and Packaged Systems

Change This (and nothing else)	Mandatory Requirements	Prescriptive Requirements
<p>Change This (and nothing else) Tap into Existing HVAC and adding >40 ft new ducting</p>	<p>Thermostat §110.2(c) §150.0(f) §150.2(b)1F Setback Thermostat or EMCS</p>	<p>Duct Insulation §150.2(b)1D R-8 for CZ 11, 14-16 R-6 for CZ 1-10, 12-13</p>
no	no	no

Mandatory Requirements	Prescriptive Requirements
<p>HERS Verified Duct Leakage² §150.2(b)1</p>	<p>HERS Verified Refrigerant §150.1(c)7 §150.2(b)1F In CZ 2, 8-15</p>
YES	no



HVAC Loads



- ✦ Building heating and cooling loads shall be determined using a method based on any one of the following:
 - ✦ The [ASHRAE Handbook, Equipment Volume](#), Applications Volume, and Fundamentals Volume; or
 - ✦ The [SMACNA Residential Comfort System Installation Standards Manual](#); or
 - ✦ The [ACCA Manual J](#).
- ✦ **Central Forced-Air Heating Furnaces: Temperature Rise.** Central forced-air heating furnace installations shall be configured to operate in conformance with the furnace manufacturer's maximum inlet-to-outlet temperature rise specifications.

NOTE: Heating systems are required to have a minimum heating capacity adequate to meet the minimum requirements of the [CBC](#).



HERS

HERS → ✦ What is required by the triggered HERS measures?

- ✦ Contractor
- ✦ HERS Rate

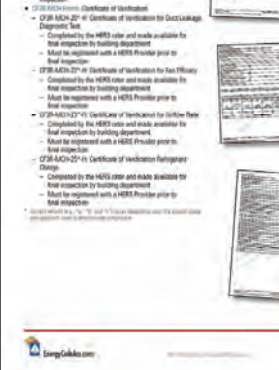
HERS Measures: Residential (based on Table RA2-1)		Mandatory	Prescriptive	Performance	Reference Appendices
DUCT MEASURES					
Duct Sealing: Verify approved duct system materials are utilized, and that duct leakage passes.		\$150.0(m)11	N/A	N/A	RA3.1.4.3



Compliance Forms

Forms → What forms will be required?
 ✦ Do they need to be registered?

Form	CF2R (Contractor)	Feature	CF3R (HERS Rater)
	CF2R-MCH-01	Equipment, controls, duct insulation	
	CF2R-MCH-20-H	Duct Testing	CF3R-MCH-20-H



- **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



Replacing Ducting and Equipment



Includes

- ✦ Ducting to be replaced and HVAC equipment being replaced

Does not Include

- ✦ Replacing ducting, but the HVAC equipment remains
- ✦ Going to ductless system





Definition

Definition ✦ What is an altered space conditioning system per the Energy Code?

What is an Altered Space-Conditioning System?

It is an alteration of an existing replacement of the space conditioning system and one or more of the following components is installed or replaced: it is considered an Altered Space-Conditioning System.

- Any refrigerant piping (compressor, condensing coil, cooling coil, expansion valve, refrigerant receiver, etc.)
- Any fan motor (compressor, condensing coil, cooling coil, expansion valve, refrigerant receiver, etc.)
- Any fan motor (compressor, condensing coil, cooling coil, expansion valve, refrigerant receiver, etc.)
- Any fan motor (compressor, condensing coil, cooling coil, expansion valve, refrigerant receiver, etc.)

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

It is an entirely new or complete replacement of a space conditioning system and one or more of the following components is installed or replaced:

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

Setback Thermostats: §110.2

Only allowed on unoccupied cooling systems subject to installation of setback thermostats. It is not allowed for heating systems applications, unless the setback heating thermostat setting is replaced, per Section 110.2(b) and 110.2(c).

Equipment Efficiency: §110.2

Heat pumps and heating equipment installed in California homes as required by the National Energy Conservation Program Act (NECA) and the California Energy Efficiency Program Act (CEEP) must comply with the California Energy Efficiency Program Act (CEEP) and the California Energy Efficiency Program Act (CEEP).

Duct Sealing and Testing (HERS measure)

Duct sealing and testing (HERS measure) is required for both altered and new replacement duct systems.

- **Expansion of Existing Ducts - 40 ft:** The measured leakage must be 1.5 CFM per 100 ft of system air leakage at 25 Pa. The leakage rate must be 1.5 CFM per 100 ft of system air leakage at 25 Pa.
- **Altered Space Conditioning System:** The measured leakage must be 1.5 CFM per 100 ft of system air leakage at 25 Pa. In addition, the system must have a cooling coil with a 300 CFM per ton of nominal cooling capacity or 250 CFM per ton of nominal heating capacity for the model that has variable systems and verified by the HERS Rater Refrigerant Charge Verification and Properly required for Climate Zones 2 and 3.
- **New/Replacement Space Conditioning System:** The Duct Sealing and Testing (HERS) measured total air leakage rate (CFM) of the system air leakage rate is to be 1.5 CFM per 100 ft of system air leakage at 25 Pa. If measured leakage is not possible an alternative method for low air permeability leaks must be used and verified through visual inspection and sealed tested by a HERS Rater.

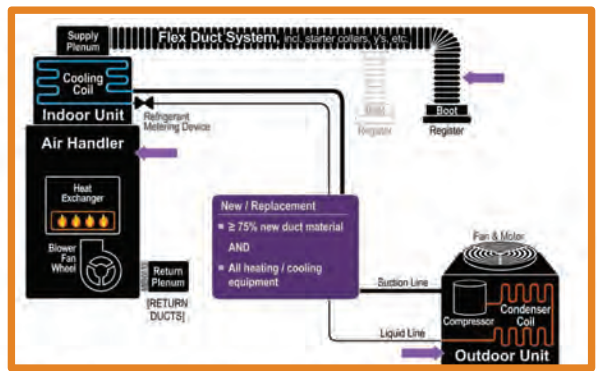


Figure 3: Entirely New or Complete Replacement Space-Conditioning System: §150.2(b)1C



Trigger

Trigger ✦ Scope of work

2019 ENERGY CODE
ACE Resources Triggers
HVAC – Alterations
 Split System and Packaged Systems

Change This (and nothing else)	Mandatory Requirements	Prescriptive Requirements
Change This (and nothing else) Add/Replace HVAC equipment and ≥75% of ducting	Thermostat §110.2(c) §150.0(f) Equipment Efficiency §110.1 §110.2(a) Setback Thermostat or EMCS §150.2(b)1F §150.2(a) exception 4-5 Cooling & Heating Loads §150.0(h) §150.2(a) exception 4-5 HERS Verified Duct Leakage? §150.2(b)1 Air Filter §150.0(m)12-13 §150.2(b)1C-D HERS Verified Airflow Rate? §150.0(m)13 §150.2(b)1C-F HERS Verified Fan Efficacy §150.0(m)13 §150.2(b)1	Duct Insulation §150.2(b)1D R-8 for CZ 11, 14-16 R-6 for CZ 1-10, 12-13 HERS Verified Refrigerant §150.1(c)7 §150.2(b)1F In CZ 2, 8-15 YES YES YES YES YES YES YES YES YES if AC YES

✦ Replacing everything



HERS



✦ What is required by the triggered HERS measures?
 ✦ Contractor
 ✦ HERS Rate

HERS Measures: Residential (based on Table RA2-1)	Mandatory	Prescriptive	Performance	Reference Appendices
DUCT MEASURES				
Duct Sealing: Verify approved duct system materials are utilized, and that duct leakage passes.	§150.0(m)11	N/A	N/A	RA3.1.4.3
Air Filter Device: Confirming the air filter devices conform §150.0(m)12.	§150.0(m)13	N/A	N/A	RA3.1.4.5
HEATING & COOLING EQUIPMENT MEASURES				
Cooling System Airflow: System airflow greater than or equal to a specified criterion.	§150.0(m)13	Exception to §150.1(c)7Aib Exception 2 to §150.2(b)Fiaa	Credit for exceeding min. Res ACM 2.4.5.2	RA3.3
Cooling System Air-Handling Fan Efficacy: Fan efficacy (W/cfm) less than or equal to a specified criterion.	§150.0(m)13	N/A	Credit for exceeding min. Res ACM 2.4.5.2	RA3.3
Refrigerant Charge/Fault Indicator Display: Air-cooled air conditioners and air-source heat pumps: diagnostically tested to verify that the system has the correct refrigerant charge. Fault Indicator Display can be installed as an alternative.	N/A	§150.1(c)7A CZ 2.8-15	Credit in CZ 1.3-7,16 Res ACM 2.4.5.1	RA1.2 RA3.2 RA3.3 RA3.4.2



HERS – Performance Extra Credit



✦ What is required by the triggered HERS measures?
 ✦ Contractor
 ✦ HERS Rate

HERS Measures: Residential (based on Table RA2-1)	Mandatory	Prescriptive	Performance	Reference Appendices
Energy Efficiency Ratio (EER): Compliance credit for increased >11.7 EER by installation of specific air conditioner or heat pump models.	N/A	N/A	§150.1(b)3Bii Res ACM 2.4.5.4	RA3.4.3 RA3.4.4.1
Seasonal Energy Efficiency Ratio (SEER): Compliance credit for increased >14 SEER by installation of specific air conditioner or heat pump models.	N/A	N/A	§150.1(b)3Bi Res ACM 2.4.5.5	RA3.4.3 RA3.4.4.1
✦ Heating Seasonal Performance Factor (HSPF): Compliance credit for >8.0 or 8.2 HSPF by installation of specific heat pump models.	N/A	N/A	§150.1(b)3Biv Res ACM 2.4.1.1	RA3.4.4.2
✦ Rated Heat Pump Capacity: When performance compliance uses a heat pump system, the heating capacity values at 47°F and 17°F must be field verified when not using default values.	N/A	N/A	§150.1(b)3Biv Res ACM 2.4.1.1	RA3.4.4.2
Evaporatively Cooled Condensers: Compliance credit for installation of evaporatively cooled condensers. Duct leakage and refrigerant charge is required.	N/A	N/A	Res ACM 2.4.5.6 Res ACM 2.4.5.7	RA1.2, RA3.2, RA3.3, RA3.4.2

If Performance Method Used



Compliance Forms



What forms will be required?
Do they need to be registered?

Forms: Which & When

In addition to a permit, Energy HERS raters require the following:

- CF1R-ALT-02-E
- Completed and signed by the installing contractor
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-H
- Certificate of Installation for Space Conditioning Systems, Ducts and Fans
- Completed and signed by the installer available for final inspection by rater
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-E
- Certificate of Work Diagnostic Test
- Completed by the HERS rater and final inspection by building department
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-F
- Certificate of Work
- Completed by the HERS rater and final inspection by building department
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-G
- Certificate of Work
- Completed by the HERS rater and final inspection by building department
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-H
- Certificate of Work
- Completed by the HERS rater and final inspection by building department
- Must be registered with a HERS Provider prior to permit application
- CF1R-MCH-20-I
- Certificate of Work
- Completed by the HERS rater and final inspection by building department
- Must be registered with a HERS Provider prior to permit application

ALTERATIONS TO SPACE CONDITIONING SYSTEMS

REG-CF1R-ALT-02-E (Revised 01/15) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE

Alterations to Space Conditioning Systems

CF1R-ALT-02-E (Page 1 of 5)

A. General Information

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

04 Building Type: _____

05 Project Name: _____

06 Date Prepared: _____

07 Dwelling Unit Name: _____

08 Dwelling Unit CTA (R#): _____

09 Number of Space Conditioning (SC) Systems in This Dwelling Unit: _____

10 _____

04	05	06	07	08	09	10
Is the SC system a ducted system?	Installing a refrigerant containing component?	Installing new SC system components?	Installing more than 20 feet of ducts?	Installing entirely new duct system?	Installing entirely new SC system?	Alteration Type:

C. Extension of Existing Duct System, Greater Than 40 Feet (Section 550.2(b)(1) Daily)

11	12	13
SC System	SC System Description of (C) Name, Area Served, & Volume	Required New Duct & Volume

Required Documentation:
CF1R-MCH-02-E - Space Conditioning System
Duct insulation requirement for the high portions of supply and return air plenums (R# (C2-1, 10, 12 & 13) and R# (C2-11 & 14-15)).
CF1R & CF1R-MCH-20-H - Duct Leakage Test
Leakage rate compliance: ≤ 2% or ≤ 10% leakage to outside, or seal all accessible leaks.
Exceptions:
Existing duct systems constructed, insulated or sealed with asbestos are exempt from MCH-20 duct leakage testing requirements.

Registration Number: _____ Registration Date/Time: _____ HERS Provider: _____ January 2024

61



Compliance Forms



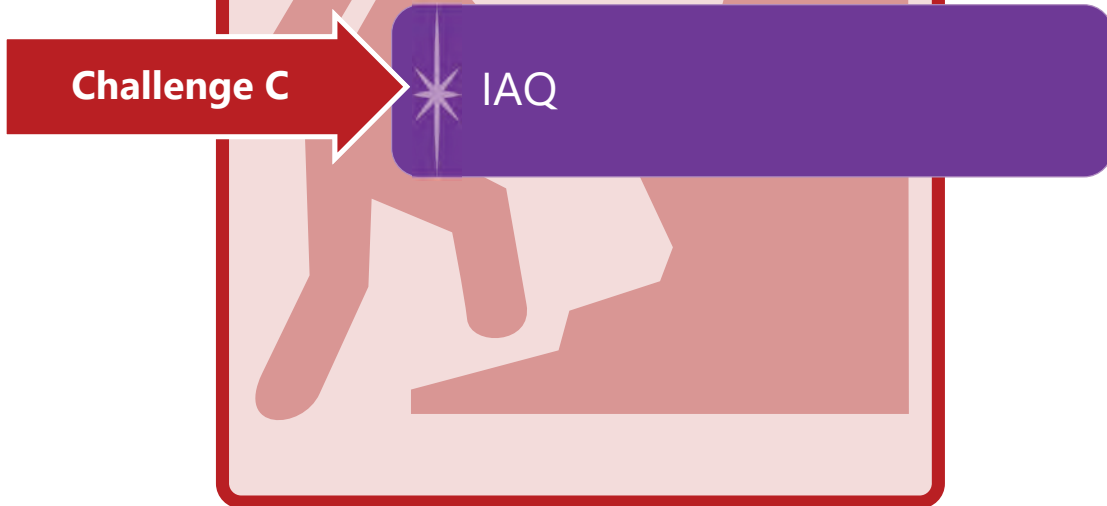
What forms will be required?
Do they need to be registered?

Form	CF2R (Contractor)	Feature	CF3R (HERS Rater)
CF2R-MCH-01		Equipment, controls, duct insulation	
CF2R-MCH-20-H		Duct Testing	CF3R-MCH-20-H
Use CF2R-MCH-01		Air Filter	
CF2R-MCH-22-H		Fan Efficacy	CF3R-MCH-22-H
CF2R-MCH-23-H		Airflow	CF3R-MCH-23-H
CF2R-MCH-25-H		Refrigerant Charge	CF3R-MCH-25-H
		Performance Extra Credit	
CF2R-MCH-26-H		Rated System Verification	CF3R-MCH-26-H

62



Challenge C



63



Local Exhaust



Includes

- ✦ Adding or altering a bathroom, kitchen or clothes dryer

Does not Include

- ✦ Whole house mechanical ventilation airflow as is required for:
 - ✦ Adding >1,000 ft² of new conditioned floor area
 - ✦ Adding an ADU of any size

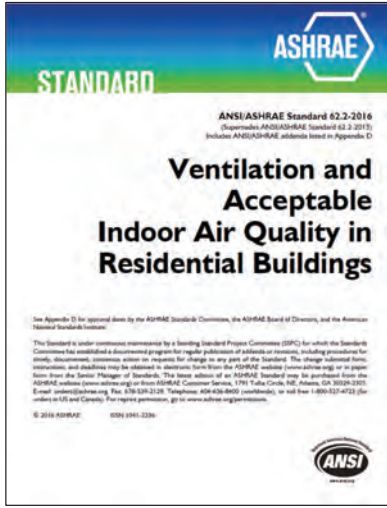




Definition



What is an altered ventilation system per the Energy Code?



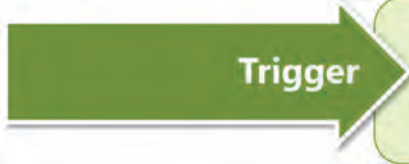
All dwelling units shall meet the requirements of ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings subject to the amendments specified in Section 150.0(o)1

5. LOCAL EXHAUST

5.1 Local Mechanical Exhaust. A local mechanical exhaust system shall be installed in **each kitchen and bathroom**. Nonenclosed kitchens shall be provided with a demand-controlled mechanical exhaust system meeting the requirements of Section 5.2.



Trigger



Scope of work



Local Exhaust

Change This (and nothing else)	HERS Verified Whole Building IAQ		Ventilation Mandatory Requirements Based on ASHRAE 62.2			
	\$150.0(c) \$150.2(a)2C	Air Filters \$150.0(m)12	Kitchen Local Exhaust \$150.0(c)	Bathroom Local Exhaust \$150.0(c)	Clothes Dryer Local Exhaust \$150.0(c)	HERS Verified Kitchen Hood \$150.0(c)
Remodeling bathroom	no	no	no	YES	no	no
Remodeling kitchen and adding kitchen hood	no	no	YES	no	no	YES
Adding dwelling unit to existing home (i.e. ADU)	YES	YES	YES	YES	If applicable	If applicable
Addition to home >1,000 ft²	YES	YES	If applicable	If applicable	If applicable	If applicable
Addition to home ≤1,000 ft²	no	no	If applicable	If applicable	If applicable	If applicable



Local Exhaust

Each local ventilation system for all kitchens and bathrooms shall be either one of the following two:

Demand-Controlled

- ✦ Mechanical exhaust system meeting the requirements of Section 5.2
 - ✦ **Control and operation**
 - ✦ **Ventilation Rate**

Continuous

- ✦ Mechanical exhaust system meeting the requirements of Section 5.3
 - ✦ **Control and operation**
 - ✦ **Ventilation Rate**

Instructions and Labeling. Information on the ventilation design and/or ventilation systems installed, instructions on their proper operation to meet the requirements of this standard, and instructions detailing any required maintenance (similar to that provided for HVAC systems) shall be provided to the owner and the occupant of the dwelling unit. Controls shall be labeled as to their function (unless that function is obvious, such as toilet exhaust fan switches).



Local Exhaust

Control and Operation

Demand-Controlled

- ✦ A readily accessible manual ON-OFF control shall be provided for each demand-controlled mechanical exhaust system.
- ✦ Automatic control devices, including but not limited to the following, **shall be permitted, provided they do not impede manual ON-OFF control:**
 - ✦ humidity sensors, shut-off timers, occupancy sensors, multiple speed fans, combined switching, IAQ sensors, etc.

Continuous

- ✦ A readily accessible manual ON-OFF control shall be provided for each continuous mechanical exhaust system. **The system shall be designed to operate during all occupiable hours.**
- ✦ Continuous operation of **central forced air system air handlers used in central fan integrated ventilation systems is not a permissible** method of providing the dwelling unit ventilation airflow required in Section 4 of ASHRAE Standard 62.2.



Local Exhaust

Ventilation Rate

Demand-Controlled

- ✦ **Kitchen:**
 - ◇ Enclosed Kitchen
 - Vented range hood (including appliance-range hood combinations): 100 cfm (50 L/s)
 - Other kitchen exhaust fans, including downdraft: 300 cfm (150 L/s) or a capacity of 5 ach
 - ◇ Nonenclosed Kitchen
 - Vented range hood (including appliance-range hood combinations): 100 cfm (50 L/s)
 - Other kitchen exhaust fans, including downdraft: 300 cfm (150 L/s)
- ✦ **Bathroom:** 50 cfm (25 L/s).



Continuous

- ✦ **Kitchen:**
 - ◇ Enclosed Kitchen 5 ach, based on kitchen volume
- ✦ **Bathroom:** 20 cfm (10 L/s)



Vented Range Hoods *NEW

\$150.0(o)2B



Range hoods (single family and low-rise multifamily) must be **HERS inspected** in the field to verify **HVI/AHAM certified** for:

- ✦ Minimum ventilation airflow rate per ASHRAE 62.2 (**100 cfm for typical kitchen layouts**)
- ✦ Maximum sound ratings per ASHRAE 62.2 (**3.0 sones**)

Other airflow options are provided in ASHRAE 62.2 for continuous ventilation



Local Exhaust

Clothes Dryer

Clothes Dryers. Clothes dryers shall be exhausted directly to the outdoors.

Exception: Condensing dryers plumbed to a drain.



150.0(h)3. Outdoor Condensing Units.

Clearances. Installed [air conditioner](#) and [heat pump](#) outdoor condensing units shall have a clearance of at least five (5) feet (1.5 meters) from the outlet of any dryer vent.



Whole House Mechanical Ventilation



Includes

- ✦ Whole house mechanical ventilation airflow as is required for:
 - ✧ Adding >1,000 ft² of new conditioned floor area
 - ✧ Adding an ADU of any size

Does not Include

- ✦ Adding ≤1,000 ft² of new conditioned floor area that is NOT an ADU
- ✦ Local exhaust

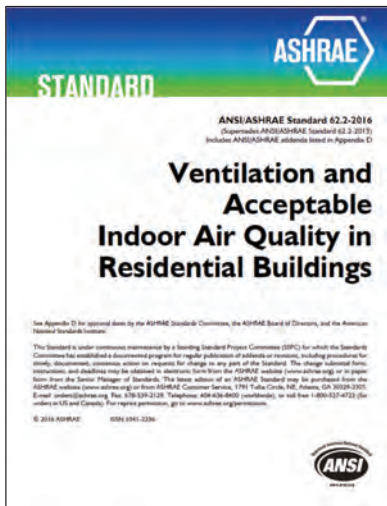




Definition



✦ What is an altered ventilation system per the Energy Code?



All dwelling units shall meet the requirements of ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings subject to the amendments specified in Section 150.0(o)1

4. DWELLING-UNIT VENTILATION (*Whole Building IAQ*)

4.1 Ventilation Rate. A mechanical exhaust system, supply system, or combination thereof shall be installed to operate for each dwelling unit to provide continuous dwelling-unit ventilation with outdoor air at a rate not less than specified in Section 4.1.1.



Trigger



✦ Scope of work



✦ Whole Building IAQ

Change This (and nothing else)	Ventilation Mandatory Requirements Based on ASHRAE 62.2					
	HERS Verified Whole Building IAQ \$150.0(c) \$150.2(a)2C	Air Filters \$150.0(m)12	Kitchen Local Exhaust \$150.0(c)	Bathroom Local Exhaust \$150.0(c)	Clothes Dryer Local Exhaust \$150.0(c)	HERS Verified Kitchen Hood \$150.0(c)
Remodeling bathroom	no	no	no	YES	no	no
Remodeling kitchen and adding kitchen hood	no	no	YES	no	no	YES
Adding dwelling unit to existing home (i.e. ADU)	YES	YES	YES	YES	If applicable	If applicable
Addition to home >1,000 ft²	YES	YES	If applicable	If applicable	If applicable	If applicable
Addition to home ≤1,000 ft²	no	no	If applicable	If applicable	If applicable	If applicable



Single-family IAQ Fans

\$150.0(o)



Applies to Additions >1,000 ft² AND when a new dwelling unit is added to an existing Residential building (i.e. ADU) *NEW

2019 Energy Code requires use of an updated formula to determine the minimum ventilation rate:

★ **Total Required Ventilation Rate (Equation 150.0-B)**

- ✦ $Q_{tot} = 0.03 \times A_{floor} + 7.5 \times (N_{br} + 1)$
 - Q_{tot} = Total required ventilation rate, cfm
 - A_{floor} = Dwelling-unit floor area, ft²
 - N_{br} = Number of bedrooms (not to be less than 1)

Example: 2,000 ft², 3-bedroom home

- ✦ Using the 2019 formula:
 - $Q_{tot} = 0.03 \times A_{floor} + 7.5 \times (N_{br} + 1)$
 - $Q_{tot} = 0.03 \times 2,000 + 7.5 \times (3 + 1)$
 - $Q_{tot} = 90 \text{ cfm}$
- ✦ Using the 2016 formula, the same home requires 50 cfm

So, the 2019 rate is **almost double** that of 2016.



HERS



★ **What is required by the triggered HERS measures?**

- ✦ Contractor
- ✦ HERS Rate

HERS Measures: Residential (based on Table RA2-1)	Mandatory	Prescriptive	Performance	Reference Appendices
MECHANICAL VENTILATION MEASURES Continuous or Intermittent IAQ: Measurement of whole-building mechanical ventilation. If central fan integrated system used, verification of installation and intermittent controls.	\$150.0(o)	N/A	N/A	RA3.7.4.1 RA3.7.4.2

Dwelling-Unit Ventilation or Continuous Local Exhaust Fans.

- These fans shall be rated for sound at a maximum of **1.0 sone**.

Demand-Controlled Local Exhaust Fans.

- Bathroom exhaust fans used to comply with Whole Building IAQ shall be rated for sound at a maximum of **3 sone**.



Compliance Forms

Forms → What forms will be required?
 ✦ Do they need to be registered?

Form	CF2R (Contractor)	Feature	CF3R (HERS Rater)
	CF2R-MCH-27-H	Indoor Air Quality and Mechanical Ventilation	CF3R-MCH-27-H

IAQ System Choices	
Continuous	Intermittent
<input type="checkbox"/> Supply <input type="checkbox"/> Exhaust <input type="checkbox"/> Balanced <input type="checkbox"/> Balanced – ERV <input type="checkbox"/> Balanced – HRV <input type="checkbox"/> Central Fan Integrated (CFI) <input type="checkbox"/> Central Ventilation System – Supply <input type="checkbox"/> Central Ventilation System – Exhaust <input type="checkbox"/> Central Ventilation System Balanced	<input type="checkbox"/> Supply <input type="checkbox"/> Exhaust <input type="checkbox"/> Balanced <input type="checkbox"/> Balanced – ERV <input type="checkbox"/> Balanced – HRV <input type="checkbox"/> Central Fan Integrated (CFI) <input type="checkbox"/> Central Ventilation System – Supply <input type="checkbox"/> Central Ventilation System – Exhaust <input type="checkbox"/> Central Ventilation System Balanced



Challenge D

Challenge D → Fuel Switching



Definition



✦ What is an electric system allowed prescriptively by the Energy Code?



- ✦ Heat pump equipment!
- ✦ Electric resistance only allowed if:
 - ✧ Adding to home: If shown it will work in performance calculation
 - ✧ Replacing in a home



HERS



✦ What is required by the triggered HERS measures?
✧ Contractor
✧ HERS Rate

HERS Measures: Residential (based on Table RA2-1)	Mandatory	Prescriptive	Performance	Reference Appendices
DUCT MEASURES				
Duct Sealing: Verify approved duct system materials are utilized, and that duct leakage passes.	§150.0(m)11	N/A	N/A	RA3.1.4.3
Air Filter Device: Confirming the air filter devices conform §150.0(m)12.	§150.0(m)13	N/A	N/A	RA3.1.4.5
HEATING & COOLING EQUIPMENT MEASURES				
Cooling System Airflow: System airflow greater than or equal to a specified criterion.	§150.0(m)13	Exception to §150.1(c)7Aib Exception 2 to §150.2(b)Fia	Credit for exceeding min. Res ACM 2.4.5.2	RA3.3
Cooling System Air-Handling Fan Efficacy: Fan efficacy (W/cfm) less than or equal to a specified criterion.	§150.0(m)13	N/A	Credit for exceeding min. Res ACM 2.4.5.2	RA3.3
Refrigerant Charge/Fault Indicator Display: Air-cooled air conditioners and air-source heat pumps, diagnostically tested to verify that the system has the correct refrigerant charge. Fault Indicator Display can be installed as an alternative.	N/A	§150.1(c)7A CZ 2.8-15	Credit in CZ 1,3-7,16 Res ACM 2.4.5.1	RA1.2 RA3.2 RA3.3 RA3.4.2



Fan Watt Draw: Ducted Mini-Splits

Compliance Considerations



- ✦ Ducted mini-splits (VCHP) systems typically utilize thermostat/display for adjustments
 - ✧ Installer settings (menus) are accessed to adjust airflow (setting access differs per product, and should be researched and available at inspection with HERS rater)

- ✦ Watt draw is typically done at the condenser and WILL require that an electrician or installer be onsite for HERS verification using approved handheld meter (not a plug-in meter)

81



HERS – Performance Extra Credit



- ✦ What is required by the triggered HERS measures?
 - ✧ Contractor
 - ✧ HERS Rate



If Performance Credit Taken

- 5% cooling over minimum efficiency
- 12% heating over minimum efficiency
- Each habitable room must be directly served by ducted air handler or ductless head – Transfer fans do not meet this requirement**
- Wall mount thermostat required in each zone > 150 ft²
- Duct in conditioned space

82



Compliance Forms



What forms will be required?
Do they need to be registered?

Forms: Which & When
In addition to a permit, Energy HERS raters require the following:

- CF1R-ALT-02-E
- CF1R-MCH-20-H
- CF1R-MCH-21-H
- CF1R-MCH-22-H
- CF1R-MCH-23-H
- CF1R-MCH-25-H
- CF1R-MCH-33-H

CF1R-ALT-02-E: Certificate of Compliance: Alteration to an HVAC System

- Completed and signed by the installing contractor
- Must be registered with a HERS Provider prior to permit application

ALTERATIONS TO SPACE CONDITIONING SYSTEMS
CALIFORNIA ENERGY COMMISSION
CF1R-ALT-02-E
CERTIFICATE OF COMPLIANCE
Alterations to Space Conditioning Systems

A. General Information
CF1R-ALT-02 is applicable to multiple space conditioning systems contained within a single dwelling unit. When multiple dwelling units must be documented, use one CF1R-ALT-02 document for each dwelling unit.

04	Building Type:	05	Date Prepared:
01	Project Name:	06	Dwelling Unit Name:
02	Project Address:	07	Dwelling Unit CTA (R#):
03	Number of Space Conditioning (SC) Systems in This Dwelling Unit:	08	Number of Space Conditioning (SC) Systems in This Dwelling Unit:

04	05	06	07	08	09	10
Is the SC system a ducted system?	Installing a refrigerant containing component?	Installing new SC system components?	Installing more than 20 feet of ducts?	Installing entirely new duct system?	Installing entirely new SC system?	Alteration Type:

C. Extension of Existing Duct System, Greater Than 40 Feet (Section 550.2(b)(1)(b))

11	12	13
SC System (Name, Area Served, R#)	SC System Description of New Duct & Volume	Required New Duct & Volume

Required Documentation:
CF1R-MCH-01 - Space Conditioning Agreements
Duct insulation requirement for the high portions of supply and return air plenums (R# (CZ 1-10, 12 & 13) and R# (CZ 11 & 14-16)).
CF1R & CF1R-MCH-20-H - Duct Leakage Test
Leakage rate compliance: ≤ 2% or ≤ 10% leakage to outside, or seal all accessible leaks.
EXISTENCE
Existing duct systems constructed, insulated or sealed with asbestos are exempt from MCH-20 duct leakage testing requirements.

Registration Number: CA Building Energy Efficiency Standards - 2019 Residential Compliance
Registration Date/Time: _____
HERS Provider: _____ January 2024



Compliance Forms



What forms will be required?
Do they need to be registered?

Form	CF2R (Contractor)	Feature	CF3R (HERS Rater)
CF2R-MCH-01		Equipment, controls, duct insulation	
CF2R-MCH-22-H		Fan Efficacy	CF3R-MCH-22-H
CF2R-MCH-23-H		Airflow	CF3R-MCH-23-H
CF2R-MCH-25-H		Refrigerant Charge (depends on CZ)	CF3R-MCH-25-H
		Performance Extra Credit	
CF2R-MCH-33-H		Variable Capacity Heat Pump(VCHP) Compliance Credit	CF3R-MCH-33-H



Next Steps



HELPING YOU PLAY YOUR CARDS RIGHT



Ace Tools™

A variety of tools to help you identify the forms, installation techniques, and standards relevant to building projects in California.

Ace it



Ace Training™

Targeted classroom and online training on Title 24, Part 6 and Title 20 addressing a variety of stakeholders and measures.

Ace it



Ace Resources™

Application Guides, Facts Sheets, Trigger Sheets and Checklists to help you understand how and when to comply with California's building and appliance energy efficiency standards.

Ace it



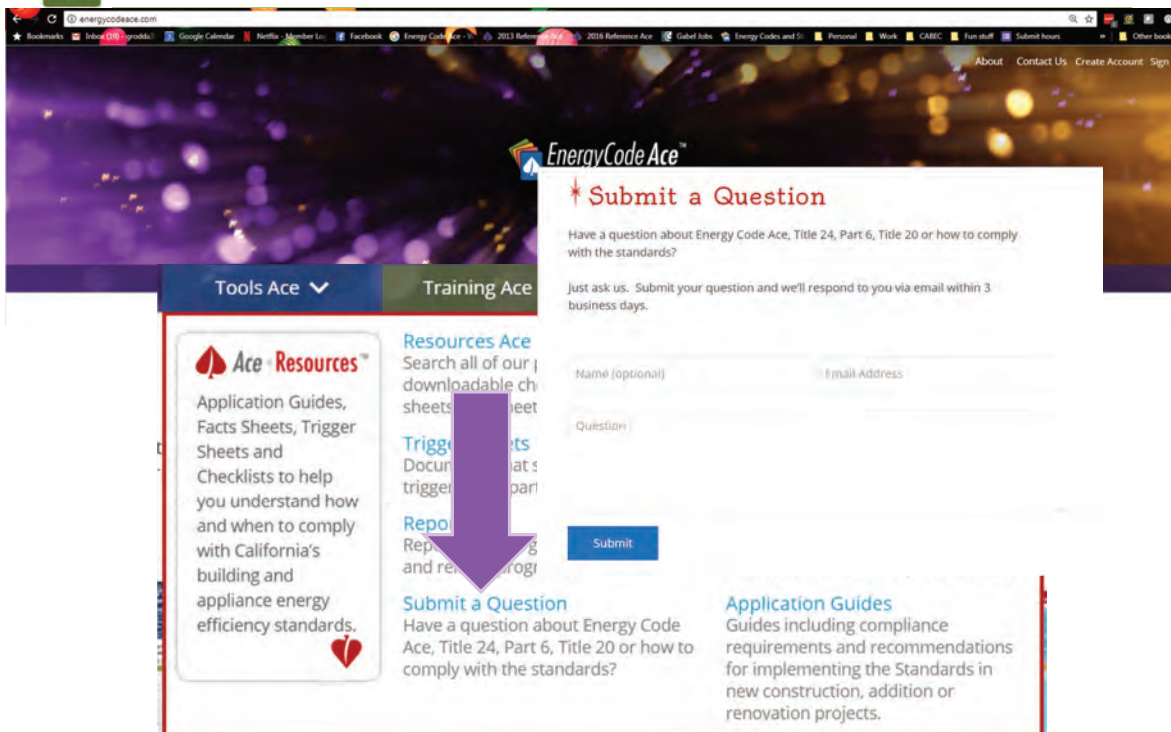


EnergyCodeAce.com/resources

87



Other ECA Resources



The screenshot shows the EnergyCodeAce.com website interface. At the top, there is a navigation bar with links for 'About', 'Contact Us', 'Create Account', and 'Sign In'. Below the navigation bar, there are two main menu items: 'Tools Ace' and 'Training Ace'. A large purple arrow points from the 'Resources Ace' link in the left sidebar to the 'Submit a Question' form in the main content area. The 'Submit a Question' form includes a title, a description, a text area for the question, and input fields for 'Name (optional)' and 'Email Address'. A 'Submit' button is located at the bottom of the form. The left sidebar contains several resource links: 'Ace Resources' (with a description of application guides, facts sheets, and checklists), 'Resources Ace' (with a description of downloadable checklists), 'Trigger Sheets' (with a description of documents that trigger compliance), 'Reports' (with a description of reports and recommendations), and 'Application Guides' (with a description of guides for compliance requirements).



Energy Commission Resources



CEC Hotline

Monday – Friday, 8 a.m. to noon, 1 p.m. to 4:30 p.m.
1-800-772-3300 (CA), (916) 654-5106 (Outside CA)
Email: Title24@energy.ca.gov

List Server & Newsletter

Main conduit for stakeholder communication:
www.energy.ca.gov/listservers/
(Subscribe to Building Standards & Blueprint Newsletter)

Download the Blueprint Newsletter:
www.energy.ca.gov/efficiency/blueprint

Other Useful Links

CEC Online Resource Center:
<https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center>

Approved Compliance Software:
www.energy.ca.gov/title24/2019standards/2019_computer_prog_list.html

Split Systems and Packaged Systems

Change This (and nothing else)	Mandatory Requirements						Prescriptive Requirements		
	Equipment Efficiency §110.1 §110.2(a)	Thermostat §110.2(c) §150.0(i) §150.2(b)1F Setback Thermostat or EMCS	Cooling & Heating Loads §150.0(h) §150.2(a) exception 4-5	HERS Verified Duct Leakage ² §150.2(b)1	Air Filter §§150.0(m)12-13 §§150.2(b)1C-D	HERS Verified Airflow Rate ³ §150.0(m)13 §150.2(b)1C-F	HERS Verified Fan Efficacy §150.0(m)13 §150.2(b)1	Duct Insulation §150.2(b)1D R-8 for CZ 11, 14-16 R-6 for CZ 1-10, 12-13	HERS Verified Refrigerant §150.1(c)7 §150.2(b)1F In CZ 2, 8-15
Replace belts, blower wheel fan, and/or electrical components	no	no	no	no	no	no	no	no	no
Tap into existing HVAC and adding ≤40 ft new ducting	no	no	YES , to verify existing HVAC meets heating load if for an addition	YES if ducting in garage	no	no	no	YES	no
Tap into Existing HVAC and adding >40 ft new ducting	no	no		YES	no	no	no	YES	no
Replace all the ducting for existing HVAC	no	no	no	YES	YES	YES	YES	YES	no
Replace Air Handling Unit and Furnace	YES	no	no	YES	no	no	no	no	no
Replace any refrigerant containing system components ⁴	no	YES	no	YES	no	Yes if HERS Refrigerant Charge required	no	no	YES
Replace a room heating / AC unit	YES	no ¹	no	no	no	no	no	no	no
Replace all HVAC equipment but no new ductwork	YES	YES	no	YES	no	YES if HERS Refrigerant Charge required	no	no	YES if AC
Add/Replace HVAC equipment and ≥75% of ducting	YES	YES	YES	YES	YES	YES if AC	YES if AC	YES	YES if AC

Note:

- Replacing the blower wheel fan is considered a repair and does NOT trigger the Energy Code.
- 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 0.75" thick insulation.

NOTES

- 1 Setback thermostats 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.
- 2 New multifamily duct system leakage must be $\leq 12\%$ in total, or $\leq 6\%$ to the outside; new single family $\leq 5\%$ leakage. Or, if unable to meet the sealing requirements, all accessible leaks must be sealed and verified by a HERS rater. HERS duct testing is not required when asbestos is present. New or replacement space-conditioning ducts, air-handling units, cooling or heating coils, or plenums located in a garage space must be $\leq 6\%$, or be sealed and verified by a HERS rater.
- 3 Applicable to new forced air ducted systems with cooling and altered system in which refrigerate charge is required. Completely new systems (equipment and ducting) can use return grille option per [Table 150.0-B or C](#), or verified per HERS verification of airflow: 0.45 W/CFM for gas furnace air-handling units (manufactured as of July 3, 2019) and 0.58 W/CFM for air-handling units that are not gas furnaces (i.e., heat pump).
- 4 Refrigerant-containing system components such as the compressor, condensing coil, evaporator coil, refrigerant metering device or refrigerant piping.

HVAC System Considerations

Equipment Type: §150.1(c)6 Electric resistance heating is not allowed to be added to a home without a performance calculation showing it will work, but can be used for altered heating equipment if already present. Heat pump equipment can always replace gas or electric resistance heating equipment without the need for a performance calculation.

§110.1/110.2(a) All HVAC equipment must be certified through [Title 20 Appliance Efficiency Standards](#) and meet minimum efficiency requirements.

Controls Required: §110.2(b) Heat pump equipment to use controls so that supplementary electric resistance strip heating is secondary to the heat pump operation.

§110.2(d) Furnaces $\geq 225,000$ BTUH, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75% of the input rating. They must also have an intermittent ignition or interrupted device (IID), and have either power venting or a flue damper. A combustion air intake vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. A setback thermostat or an Energy Management Control System (EMCS) must be programmed to provide, at a minimum, functionality required of a setback thermostat.

Condensers (AC): §150.0(h)3 Must be located a min. 5' clearance from dryer vent outlet.

Refrigerant: §150.0(j) Refrigerant pipe insulation & protection is required of all new piping.

§150.2(b)Fiib. When HERS refrigerant charge verification is required prescriptively, a demand responsive HVAC control (Wi-Fi thermostat that can be accessed remotely) may be required if outdoor temperatures are less than 55°F. This should be confirmed with HERS rater.

§150.1(c)7A Exception allows for packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory to be exempt from HERS verification of refrigerant charge.

Air Filters: §§150.0(m)12, 150.2(b)1C and 150.2(b)1Diia Air filters to be 2" MERV-13 when an entirely new or complete replacement HVAC system (equipment and ducts) has >10 ft of ducting. This also applies to complete duct replacements. Alternative filter options may apply.

Duct Insulation: §150.0(m) New ducting min. Performance method allows R-4.2 when the duct system is entirely inside conditioned space and confirmed by a HERS rater. Portions of the duct that are completely exposed to and surrounded by directly conditioned space are not required to be insulated.

§150.2(b)1D Prescriptive requirements require new ducting min. insulation in unconditioned spaces of R-8 in Climate Zones (CZ) 11, 14-16 and R-6 in CZ 1-10, 12-13.

Ventilation Mandatory Requirements Based on ASHRAE 62.2

Change This (and nothing else)	HERS Verified Whole Building IAQ §150.0(o) §150.2(a)2C	Air Filters §150.0(m)12	Kitchen Local Exhaust §150.0(o)	Bathroom Local Exhaust §150.0(o)	Clothes Dryer Local Exhaust §150.0(o)	HERS Verified Kitchen Hood §150.0(o)
Remodeling bathroom	no	no	no	YES	no	no
Remodeling kitchen and adding kitchen hood	no	no	YES	no	no	YES
Adding dwelling unit to existing home (i.e. ADU)	YES	YES	YES	YES	If applicable	If applicable
Addition to home $>1,000$ ft ²	YES	YES	If applicable	If applicable	If applicable	If applicable
Addition to home $\leq 1,000$ ft ²	no	no	If applicable	If applicable	If applicable	If applicable

For More Information

Primary Sources

- Energy Code Section 110.1 – Mandatory Requirements for Appliances
energycodeace.com/site/custom/public/reference-ace-2019/Documents/section1101mandatoryrequirementsforappliances.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 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/section1501performanceandprescriptivecomplianceapproachesfornew.htm
- Energy Code Section 150.2 – Energy Efficiency Standards for Additions and Alterations in Existing Buildings that Will Be Low-Rise Residential Occupancies
energycodeace.com/site/custom/public/reference-ace-2019/index.html#!Documents/section1502energyefficiencystandardsforadditionsandalterationsto.htm
- Energy Code Residential Compliance Manual, Chapter 4.6 – HVAC Building Requirements, Indoor Air Quality and Mechanical Ventilation
energycodeace.com/site/custom/public/reference-ace-2019/Documents/46indoorairqualityandmechanicalventilation.htm

California Energy Commission Information & Services

- Energy Code Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
www.energy.ca.gov/programs-and-topics/programs/buildingenergy-efficiency-standards/online-resource-center
 - The Energy Commission’s main web portal for 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: Fact Sheets

energycodeace.com/content/resources-fact-sheets

- 2019 Fact Sheet on Residential HVAC Alterations

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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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

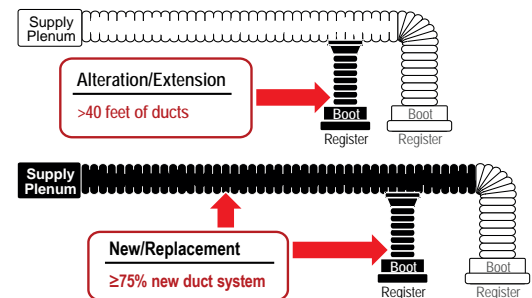


Figure 1: Altered or Replaced Duct Systems (Duct Sealing): §150.2(b)1D

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.

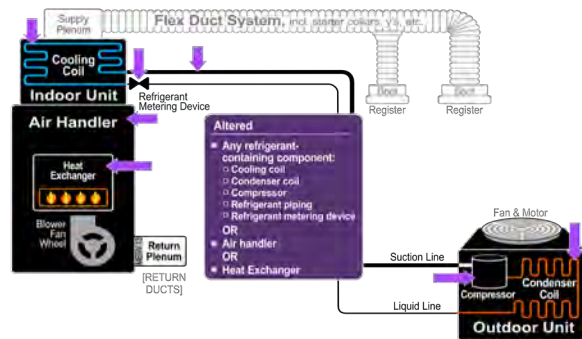


Figure 2: Altered Space-Conditioning System: §150.2(b)1E,F

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

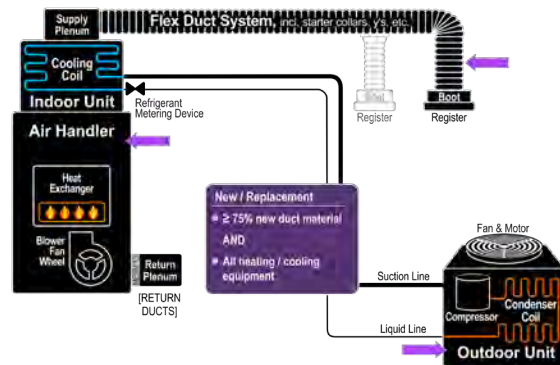


Figure 3: Entirely New or Complete Replacement Space-Conditioning System: §150.2(b)1C

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 $\leq 15\%$ 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 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 $\leq 5\%$ 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 $\leq 6\%$ 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
 CF1R-ALT-02-E requires multiple space conditioning systems contained within a single dwelling unit. When multiple dwelling units must be addressed, use the CF1R-ALT-02-E documents for each dwelling unit.

B. Space Conditioning (SC) System Information
 SC System Description: SC System Type, Heating System Type, Cooling System Type, Distribution System Type, Equipment Type, Low Leakage Air-Handling Unit Details, System Status, Cooling Design Type, Control System Type.

C. Extension of Existing Duct System, Greater Than 40 Feet (Section 100.20(1)(a))
 SC System Description: SC System Type, Heating System Type, Cooling System Type, Distribution System Type, Equipment Type, Low Leakage Air-Handling Unit Details, System Status, Cooling Design Type, Control System Type.

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

A. General Information
 Dwelling Unit Name, Heating Load Calculated Prior to this Project, Certificate of Compliance Type, Calculated Heating Load (Btu/h), Calculated Cooling Load (Btu/h), Dwelling Unit Number of Bedrooms.

B. Design Space Conditioning (SC) System Component Specifications for this Project
 This table reports the space conditioning system features that are specified for the regulated space and are required for this project.

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

DUCT LEAKAGE DIAGNOSTIC TEST
CERTIFICATE OF VERIFICATION
 Duct Leakage Diagnostic Test

A. System Information
 Space Conditioning System Identification or Name, Space Conditioning System Location in Area Served, Building Type from CF1R, Intended Use (e.g., Residential, Commercial, Industrial, etc.), Duct System Compliance Category, and Area portion of Duct Located in Category.

MCH-01a - Complete New Duct System
 Air-Handling Unit (AHU) or Fan Coil Unit (FCU) Identification Number, Conditioner Pressure Coefficient Capacity (lbm), Indoor Air System Overall Capacity, Heating Capacity (Btu/h), Conditioner from area served by this HVAC system (SC), Maximum Airflow (CFM), Duct Leakage Test Conditions, Duct Leakage Test Method, Leakage Factor, and Calculated Design Heating (Design Heating Load) (Btu/h).

MCH-01b - Complete New Duct System
 Actual Duct Leakage Rate (per Leakage Test Method) and Compliance Percentage.

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

California Energy Commission Information & Services

- Energy Code Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
www.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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What is HERS?

Field verification and diagnostic testing are performed by special third-party inspectors called Home Energy Rating System (HERS) Raters. The California Energy Commission has given this responsibility to the HERS Raters, who must be specially trained and certified to perform these services to address poor construction quality and equipment installation. In California's 2019 Building Energy Efficiency Standards (Title 24, Part 6 or Energy Code) technologies and systems that trigger HERS verification are considered "HERS measures." These cover a variety of features such as HVAC systems, plumbing and insulation installation for residential and nonresidential projects. In order to verify these HERS measures, certified HERS Raters perform onsite inspections and tests, to ensure proper installation per verification procedures defined by the Energy Commission (which can be found in the applicable Energy Code Reference Appendices).

Why should I care about HERS?

As a homeowner or building owner, you should expect your building features to be installed as designed and compliant with the Energy Code. The HERS verification process ensures that the proposed HERS measures are installed and meet code compliance.

As a contractor or developer, verification that the installed building features are meeting the energy performance expected by the Energy Code, assures your clients and future building owners of the building's future energy-efficiency potential.

When are HERS raters required?

A HERS rater is required when the Certificate of Compliance indicates HERS measures are required.

Residential Buildings: New homes and additions over 1,000 ft², will always require HERS measures meaning a HERS Rater will always be required. For additions 1,000 ft² or less and any alteration to an existing home, HERS verification requirements will depend on the building features being added or altered with a building permit and will be listed on the Certificate of Compliance (CF1R) form.

Nonresidential/High-Rise Multifamily/Hotel and Motel Buildings: HERS verification requirements for new buildings, additions and alterations will depend on the building features included with the permitted project and will be listed on the Certificate of Compliance (NRCC) form.

Who Hires the HERS Rater?

The building owner or the general contractor typically hires the HERS Rater. HERS Raters cannot be employees of the builder or contractor whose work they are verifying. Also HERS Raters cannot have a financial interest in the builder's or contractor's business, or advocate or recommend the use of any product or service that they are verifying.

Typically a HERS Rater should be selected at the beginning of construction so they can inform the contractor about when they need to perform inspections and testing. It is important to coordinate with the energy consultant or documentation author when assigning a Rater to the project. This allows the Rater to have access to the registered compliance documentation associated with the project.

Who Does What?

HERS Raters

have been trained and certified by a HERS Provider to verify compliance of HERS measures with California's Energy Code. They are third-party inspectors who perform field verification and diagnostic testing services for the benefit of the homeowner or building owner to ensure proper measure installation and systems operation.

HERS Providers

are organizations approved by the California Energy Commission to train and certify HERS Raters, and conduct quality assurance reviews to maintain consistency among HERS Raters. Providers also maintain a HERS registry, which contains a database of projects and related compliance documents.

Building Inspectors

perform inspections for all Building Codes (Structural, Electrical, Plumbing, etc.) throughout construction. HERS Raters are special inspectors to the Building Inspector and must demonstrate competence, to the satisfaction of the building official, for the visual inspections and diagnostic testing that they perform.

Acceptance Test Technicians (ATT)

are contractors trained via an ATTCP provider and may be able to provide verification for HERS measures associated with high-rise multifamily, hotel/motel and nonresidential buildings once the Energy Commission approves the ATTCP for HERS measure verification (as of September 2019, none have been approved).

Compliance Documents

There are several documents that the Building Department will need in order to verify code compliance. There are three types of Compliance Documents required at different stages of construction. These include:



- Certificate of Compliance (**NRCC** for nonresidential/high-rise multifamily/hotel & motel; **CF1R** for residential/low-rise multifamily): Documents the building features required to comply with the Energy Code. These features will vary depending on the particular project and the compliance approach used and are submitted to the building department as part of the building permit application.
- Certificate of Installation (**NRCI** for nonresidential/high-rise multifamily/hotel & motel; **CF2R** for residential/low-rise multifamily): Documents that the building products and features actually installed in the field match those required in the Certificates of Compliance. To be completed and signed by the installer or builder responsible for installing regulated building.
- Certificate of Verification (**NRCV** for nonresidential/high-rise multifamily/hotel & motel; **CF3R** for residential/low-rise multifamily): Documents compliance with applicable HERS measures. To be completed and signed by a HERS rater.

What to do when “registered” forms are required

Registering compliance documentation is a process designed to ensure that equipment is installed in accordance with the Energy Code requirements listed on the Certificate of Compliance.

- Residential/low-rise multifamily: The Building Department will require a registered **CF1R** before issuing a permit if HERS measures are required (with limited exceptions pertaining to HVAC alterations).
- Nonresidential/high-rise multifamily/hotel & motel: The **NRCC** is not required to be registered for permit application, only the applicable **NRCV** form(s) are required to be registered before final inspection.

The registration process is generally initiated by the energy consultant or compliance documentation author. This process will require the owner or contractor to establish an account with the HERS Provider in order to “sign-off” (approve the documentation) before a registered **CF1R** may be printed. This is an important step in the process and should be completed to prevent delays in registration.

To establish an account with a HERS Provider, go to a provider’s website and follow their directions based on your role (home owner, contractor or architect/designer). For security purposes, this process will require you to provide personal identification. Once your account is established, you will have access to either create or “sign-off” on a project, whichever is applicable.

Once the **CF1R** has been approved and signed-off by all responsible parties, it is ready to be printed and submitted to the Building Department. The registered compliance documents will contain a unique registration number, date and time stamp, and name of HERS Provider at the bottom of each page. This tells the Building Department that the documents are registered. If any changes occur to the scope of work, the **CF1R** will need to be revised, registered, and re-submitted to the Building Department for approval.




Registration Number: thisisnotareal#	Registration Date/Time: 5/5/55 5:55	HERS Provider: HERSRUS
CA Building Energy Efficiency Standards - 2019 Residential Compliance	Report Version: CF1R-04141016-574	Report Generated at: 4/29/2020:9:35:55 PM

Residential (Single Family and Low-Rise Multifamily) Requirements

The following table reflects the HERS measures associated with single family homes and low-rise multifamily buildings for new construction, additions and alterations. Note that some HERS measures are Mandatory, some are Prescriptive and some are not required but are used only for Performance credits.

HERS Measures: Residential (based on Table RA2-1)	Mandatory 	Prescriptive 	Performance 	Reference Appendices
DUCT MEASURES				
Duct Sealing: Verify approved duct system materials are utilized, and that duct leakage passes.	§150.0(m)11	N/A	N/A	RA3.1.4.3
Return Duct Design: Confirm that the return duct design conform to the criteria per given §150.0(m)13; or Cooling System Airflow verification. Includes confirming the air filter devices conform §150.0(m)12.	§150.0(m)12 §150.0(m)13	N/A	N/A	RA3.1.4.4 RA3.1.4.5
Air Filter Device: Confirming the air filter devices conform §150.0(m)12.	§150.0(m)13	N/A	N/A	RA3.1.4.5
Zonally Controlled Central FAU (bypass ducts): Zonally controlled systems comply with the bypass duct requirements in §150.1(c)13. Performance penalty if bypass ducts used.	§150.0(m)12	Not allowed per §150.1(c)13	Res ACM 2.4.8.4	RA3.1.4.6
Ducts (Low Leakage) in Directly Conditioned Space: Duct system location must be verified. Duct sealing is also required.	N/A	HPA Option B §150.1(c)9	Res ACM 2.4.6.2 Res ACM 2.4.6.13	RA3.1.4.3.8
Duct Design / Buried Ducts / Deeply Buried Ducts: Duct system installed according to the design, including location, size and length of ducts, duct insulation R-value. For buried ducts measures. Duct Sealing and verification of insulation required.	N/A	N/A	N/A	RA3.1.4.1
HEATING & COOLING EQUIPMENT MEASURES				
Low Leakage Air-Handling Units: Verification of a factory sealed air handling unit tested by the manufacturer and certified. Duct Sealing is also required.	N/A	N/A	§150.1(b)3Biii Res ACM 2.4.6.11 Res ACM 2.4.6.12	RA3.1.4.3.9
Cooling System Airflow: System airflow greater than or equal to a specified criterion.	§150.0(m)13	Exception to §150.1(c)7Aib Exception 2 to §150.2(b)Fiia	Credit for exceeding min. Res ACM 2.4.5.2	RA3.3
Cooling System Air-Handling Fan Efficacy: Fan efficacy (W/cfm) less than or equal to a specified criterion.	§150.0(m)13	N/A	Credit for exceeding min. Res ACM 2.4.5.2	RA3.3
Refrigerant Charge/Fault Indicator Display: Air-cooled air conditioners and air-source heat pumps diagnostically tested to verify that the system has the correct refrigerant charge. Fault Indicator Display can be installed as an alternative.	N/A	§150.1(c)7A CZ 2,8-15	Credit in CZ 1,3-7,16 Res ACM 2.4.5.1	RA1.2 RA3.2 RA3.3 RA3.4.2
Energy Efficiency Ratio (EER): Compliance credit for increased >11.7 EER by installation of specific air conditioner or heat pump models.	N/A	N/A	§150.1(b)3Bii Res ACM 2.4.5.4	RA3.4.3 RA3.4.4.1
Seasonal Energy Efficiency Ratio (SEER): Compliance credit for increased >14 SEER by installation of specific air conditioner or heat pump models.	N/A	N/A	§150.1(b)3Bi Res ACM 2.4.5.5	RA3.4.3 RA3.4.4.1
◆ Heating Seasonal Performance Factor (HSPF): Compliance credit for >8.0 or 8.2 HSPF by installation of specific heat pump models.	N/A	N/A	§150.1(b)3Biv Res ACM 2.4.1.1	RA3.4.4.2
◆ Rated Heat Pump Capacity: When performance compliance uses a heat pump system, the heating capacity values at 47°F and 17°F must be field verified when not using default values.	N/A	N/A	§150.1(b)3Biv Res ACM 2.4.1.1	RA3.4.4.2
Evaporatively Cooled Condensers: Compliance credit for installation of evaporatively cooled condensers. Duct leakage and refrigerant charge is required.	N/A	N/A	Res ACM 2.4.5.6 Res ACM 2.4.5.7	RA1.2, RA3.2, RA3.3, RA3.4.2

◆ **New** for the 2019 Code Cycle

HERS Measures: Residential (based on Table RA2-1)	Mandatory 	Prescriptive 	Performance 	Reference Appendices
MECHANICAL VENTILATION MEASURES				
◆ Whole House Fan Ventilation Cooling: When performance compliance uses a whole house fan, the installed whole house fan airflow rate (cfm) and fan efficacy (W/cfm) shall be verified.	N/A	N/A	§150.1(b)3Bvi Res ACM 2.4.10	RA3.9
◆ Central Fan Ventilation Cooling: When performance compliance uses a central fan ventilation cooling system (CFVCS), the installed CFVCS ventilation airflow rate (cfm) and fan efficacy (W/cfm) must be verified.	N/A	N/A	§150.1(b)3Bvii Res ACM 2.4.10	RA3.3.4
Continuous or Intermittent IAQ: Measurement of whole-building mechanical ventilation. If central fan integrated system used, verification of installation and intermittent controls.	§150.0(o)	N/A	N/A	RA3.7.4.1 RA3.7.4.2
◆ Kitchen Range Hood: The verification procedure must consist of visual inspection of airflow and sound rating via certified rating data from the Home Ventilating Institute (HVI) Certified Home Ventilating Products Directory or another Energy Commission-approved directory.	§150.0(o)2B	N/A	N/A	RA3.7.4.3
BUILDING ENVELOPE MEASURES				
Building Envelope Air Leakage: Performance compliance credit can be taken for reduced building envelope air leakage.	N/A	N/A	§150.1(b)3Bviii Res ACM 2.2.5.1	RA2.2.4.1
◆ Quality Insulation Installation (QII): Prescriptive measure in all climate zones for newly constructed buildings and additions >700 ft ² , except low-rise multifamily buildings in CZ 7.	N/A	§150.1(c)1E	§150.1(b)3Bix Res ACM 2.2	RA3.5
Spray Polyurethane Foam (SPF) QII: Verify the installation of SPF insulation when R-values better than the default used for compliance credit. (Default = open cell @ 3.6 per inch / closed cell @ 5.8 per inch)	N/A	N/A	Res ACM 2.3.3	RA3.5.6
SINGLE FAMILY DOMESTIC HOT WATER				
Pipe Insulation Compliance Credit: Inspection must verify that all hot water piping in non-recirculating systems is insulated and that corners and tees are fully insulated.	N/A	N/A	Res ACM 2.9	RA3.6.3
Parallel Piping Compliance Credit: Inspection that requires that the measured length of piping between the water heater and single central manifold does not exceed five feet.	N/A	N/A	Res ACM 2.9	RA3.6.4
Compact Hot Water Distribution System Compliance Credit: Longest pipe run from the water heater to a HW fixture does not exceed a maximum length per RA3.6.5	N/A	§150.1(c)8Aiiia §150.1(c)8Aiva	Res ACM 2.9	RA3.6.5
Recirculation Pump Controls: Pipe insulation inspection required, and verification of controls specified in performance compliance documents.	N/A	N/A	Res ACM 2.9	RA3.6.1 - RA3.6.7
◆ Drain Water Heat Recovery: Inspection to verify that the DWHR unit(s) and installation configuration match the compliance document and the DWHR(s) is certified to the Commission to have met the requirements.	N/A	§150.1(c)8Aiiib §150.1(c)8Aiva §150.1(c)8Biiib	Res ACM 2.9	RA3.6.9

◆ **New** for the 2019 Code Cycle

HERS Measures: Residential (based on Table RA2-1)	Mandatory 	Prescriptive 	Performance 	Reference Appendices
MULTIFAMILY DOMESTIC HOT WATER				
Multiple Recirculation Loop Design and Controls: Performance credit for HERS inspection that a central DHW system serving a building with more than 8 dwelling units has at least 2 recirculation loops, each serving roughly the same number of dwelling units.	N/A	N/A	Res ACM Appendix B	RA3.6.8
◆ Drain Water Heat Recovery: Inspection to verify that the DWHR unit(s) and installation configuration match the compliance document and the DWHR(s) is certified to the Commission to have met the requirements.	N/A	§150.1(c)8Biii	Res ACM 2.9	RA3.6.9
PRE-EXISTING VERIFIED MEASURES				
Performance compliance credit for improving an existing building feature beyond “default” per Table 150.2-C, verified by visual inspection before building permit is pulled.	N/A	N/A	Res ACM 2.10.4	Res ACM Appendix G

Nonresidential, High-Rise Multifamily and Hotel/Motel Requirements

The following table reflects the HERS measures associated with nonresidential, high-rise multifamily and hotel/motel buildings for new construction, additions and alterations.

HERS Measures: Nonresidential (based on Table NA1-1)	Mandatory 	Prescriptive 	Performance 	Reference Appendices
DUCT MEASURES				
Duct Sealing: Field verification and diagnostic testing is required to verify that approved duct system materials are utilized, and that duct leakage meets the specified criteria for constant volume single zone system(s) serving less than 5,000 ft ² when more than 25% of the ducting is outside the conditioned space.	N/A	§140.4(l)	NR ACM 5.7.3.6	NA2.1.4.2
MULTIFAMILY DOMESTIC HOT WATER				
Multiple Recirculation Loop Design and Controls: Performance credit for HERS inspection that a central DHW system serving a building with more than eight dwelling units has at least two recirculation loops, each serving roughly the same number of dwelling units.	N/A	N/A	High-Rise: NR ACM 5.9.1.3 Res ACM Appendix B	RA3.6.8
◆ Drain Water Heat Recovery: Inspection to verify that the DWHR unit(s) and installation configuration match the compliance document and the DWHR(s) is certified to the Commission to have met the requirements.	N/A	§150.1(c)8Biii	Res ACM 2.9	RA3.6.9
MULTIFAMILY MECHANICAL VENTILATION MEASURES				
◆ Continuous or Intermittent IAQ: Measurement of whole-building mechanical ventilation per ASHRAE 62.2. If central fan integrated system used, verification of installation and intermittent controls.	§120.1(b)2Aivb	N/A	N/A	NA2.2.4.1 NA2.2.4.1.3
◆ Building Envelope Air Leakage: Measure the air leakage rate through a high-rise residential dwelling unit enclosures measured in cubic feet per minute when intermittent IAQ used.	§120.1(b)2Aivb2	N/A	N/A	NA2.3
◆ Kitchen Range Hood: The verification procedure shall consist of visual inspection of airflow and sound rating via certified rating data from the Home Ventilating Institute (HVI) Certified Home Ventilating Products Directory or another Energy Commission-approved directory.	§120.1(b)2Avi	N/A	N/A	RA3.7.4.3

◆ **New** for the 2019 Code Cycle

For More Information

Find A...

- HERS Rater:
www.calcerts.com
www.cheers.org
- Certified Energy Analyst:
cabec.org/find/cea-current/

California Energy Commission Information & Services

- Energy Code Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center
 - The Energy Commission’s main web portal for Energy Code, including information, documents, and historical information
- Home Energy Rating System (HERS) Program Sub-site:
energy.ca.gov/HERS/
- What is Your Home Energy Rating booklet:
www.energy.ca.gov/HERS/booklet.html
- California Building Climate Zone Map:
caenergy.maps.arcgis.com/apps/webappviewer/index.html?id=4831772c00eb4f729924167244bbca22

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:

- Forms Ace:
EnergyCodeAce.com/content/forms-ace/
 - An interactive tool designed to help you determine which Title 24, Part 6 Forms are applicable to your specific project

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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Gas- and Oil-Fired Central Furnaces – Minimum Heating Efficiencies

Appliance	Rated Input (Btuh)	Minimum Efficiency (%)	
		AFUE	Thermal Efficiency
Weatherized gas central furnaces with single phase electrical supply	<225,000	81%	—
Non-weatherized gas and oil central furnaces with single phase electrical supply	<225,000	80%	—
Weatherized oil central furnaces with single phase electrical supply	<225,000	78%	—
Non-weatherized oil central furnaces with single phase electrical supply	<225,000	83%	—
Gas central furnaces	≥225,000	—	80%
Oil central furnaces	≥225,000	—	81%

Table 4-1 of 2019 Residential Compliance Manual (based on the California Appliance Efficiency Regulations Title 20, Tables E-5 and E-6)

Heat Pump – Minimum Heating Efficiencies

Single-phase air source heat pumps

Configuration	Size (Btuh)	Minimum Heating Efficiency
Packaged	<65,000 Cooling Capacity	8.0 HSPF
Split	<65,000 Cooling Capacity	8.2 HSPF
Space-constrained packaged	<65,000 Cooling Capacity	7.4 HSPF
Space-constrained split	<65,000 Cooling Capacity	7.4 HSPF
Small Duct High Velocity	<65,000 Cooling Capacity	7.2 HSPF

Note – HSPF: Heating Season Performance Factor

Adapted from Table 4-3 of 2019 Residential Compliance Manual (based on Title 20)

(Smaller) Central Air Conditioners and Heat Pumps — Minimum Cooling Efficiencies

Appliance	Type	Size (Btuh)	SEER Effective 1/1/2015	EER Effective 1/1/2015
Central Air Conditioners	Split System	< 45,000	14.0	12.2
		≥ 45,000 and < 65,000	14.0	11.7
	Single Package	< 65,000	14.0	11.0
Central Air Source Heat Pumps	Split System	< 65,000	14.0	NR
	Single Package	< 65,000	14.0	NR
Space Constrained Air Conditioner	Split System	< 65,000	12.0	NR
	Single Package	< 65,000	12.0	NR
Space Constrained Heat Pump	Split System	< 65,000	12.0	NR
	Single Package	< 65,000	12.0	NR
Small Duct, High Velocity Air Conditioner	All	< 65,000	12.0	NR
Small Duct, High Velocity Heat Pump	All	< 65,000	12.0	NR

Adapted from Table 4-6 from 2019 Residential Compliance Manual (based on Title 20 Table C-3 and Federal Appliance Standards)

Federally Regulated Residential Water Heaters — Minimum Domestic Hot Water (DHW) Efficiencies

Product Class	Rated Storage Volume/Input Rating (if applicable)	Draw Pattern	Uniform Energy Factor (UEF) Minimum Requirement
Gas-fired Storage Water Heater (≥20 gal and ≤ 55 gal)	40 gallon	Medium	0.5803
	50 gallon		0.5633
	40 gallon	High	0.64
	50 gallon		0.627
Gas-fired Storage Water Heater (>55 gal and ≤ 100 gal)	60 gallon	Medium	0.7657
	70 gallon		0.7617
	80 gallon		0.7577
	90 gallon		0.7537
	100 gallon	High	0.7497
	60 gallon		0.7892
	70 gallon		0.7862
	80 gallon		0.7832
	90 gallon		0.7802
	100 gallon		0.7772
Instantaneous Gas-fired Water Heater	<2 gal and > 50,000 Btuh	Low/Medium/High	0.81
Instantaneous Electric Water Heater	<2 Gal	Very Small/Low/Medium	0.91
Grid-enabled Water Heater	80 gallon	High	0.916
	90 gallon		0.909
	100 gallon		0.902

Note – Vr= Rated Storage Volume – the water storage capacity of a water heater (in gallons).

From Table 5-4 of the 2019 Residential Compliance Manual (per U.S. Department of Energy)



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