



Decoding 2016 HERS

*Let's Talk About Residential and
Nonresidential HERS Measures*



HELPING YOU PLAY YOUR CARDS RIGHT



Recording For Future Use



**This session
is being
recorded.**

-  **Decoding** * **Forms**™
-  **Decoding** * **CXR**™
-  **Decoding** * **CBECC-COM**™
-  **Decoding** * **Electrical Distribution**™
-  **Decoding** * **Multifamily**™
-  **Decoding** * **2016 Title 24, Part 6**™
-  **Decoding** * **Attics and Walls**™
-  **Decoding** * **2016 Nonresidential Lighting**™
-  **Decoding** * **2016 Resources**™
-  **Decoding** * **Residential Compliance**™

Last Decoding Talk...





Brought to you by...

California Statewide Codes & Standards



EnergyCode AceTM
Helping you play your cards right



This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy 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), 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; and host of various webinars specific to Title 24 (Part 6) Building Energy Efficiency Standards.

Gina has been in the energy modeling field since 1991, starting the *ninth* California building energy code cycle of her career.



Who Are We?



Russ King
CalCERTS, Inc.
russ@calcerts.com



Co-Host: Russ King

Russell King, M.E. is a professional mechanical engineer licensed in California, Nevada and Hawaii.

He has over 25 years of experience in the areas of HVAC design, diagnostics and consulting, as well as energy code compliance and consulting. He has taught professional level training on all of these topics. Russ is currently the Senior Director of Technical Services at CalCERTS, Inc., a California HERS Provider.

He earned a Bachelor of Science Degree in Environmental Resources Engineering with an Energy Resources Emphasis from Humboldt State University.



HERS Measures



- ✦ Be aware of the triggers for the various Mandatory, Prescriptive and Performance HERS measures for residential and nonresidential buildings;
- ✦ Understand how HERS measures can be supported at the design and construction phase;
- ✦ Have confidence in your understanding of the “sampling” method used for HERS verification.



Agenda

Agenda for Today Approx. Length

✦ Welcome..... 10 minutes

✦ Why?!..... 20 minutes

✦ Let's Talk

✧ *Challenge A:* 30 minutes

✧ *Challenge B:* 20 minutes

✧ *Challenge C:* 10 minutes

✧ *Challenge D:* 20 minutes

✦ Next Steps..... 5 minutes

✦ Wrap Up..... 5 minutes



We would like to know
about *you*.





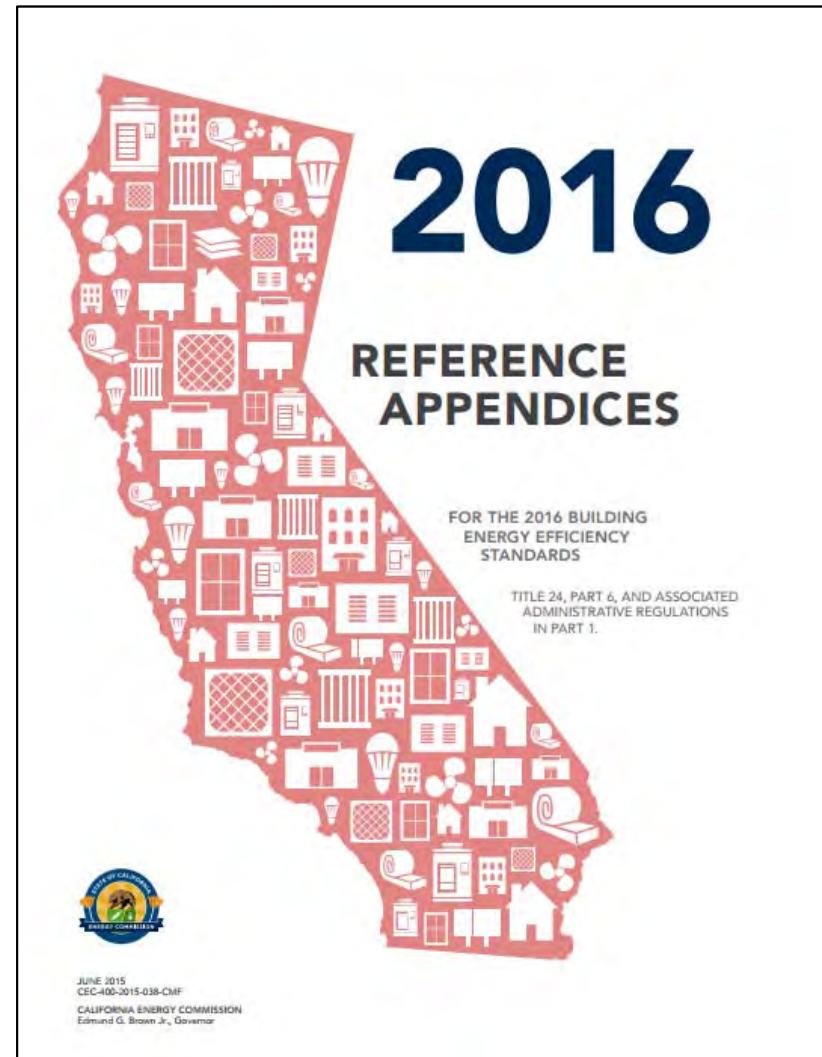
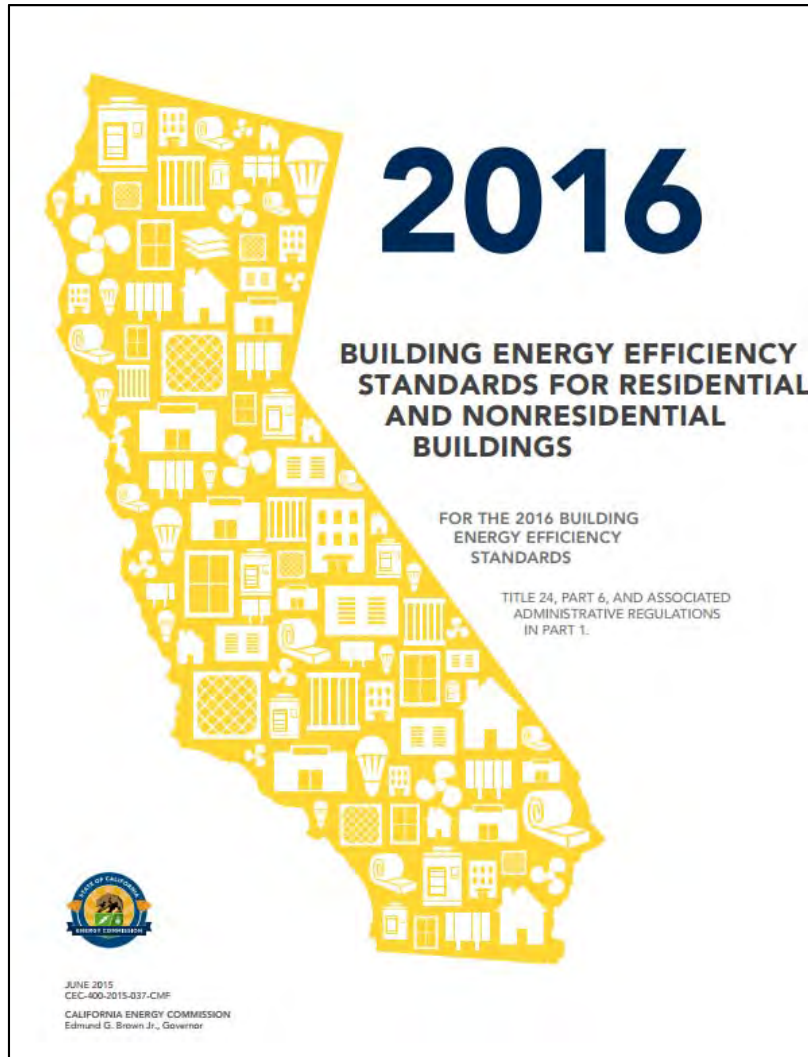
Why?



HELPING YOU PLAY YOUR CARDS RIGHT



What? Title 24 Part 6: Energy Code



<http://www.energy.ca.gov/title24/2016standards/index.html>



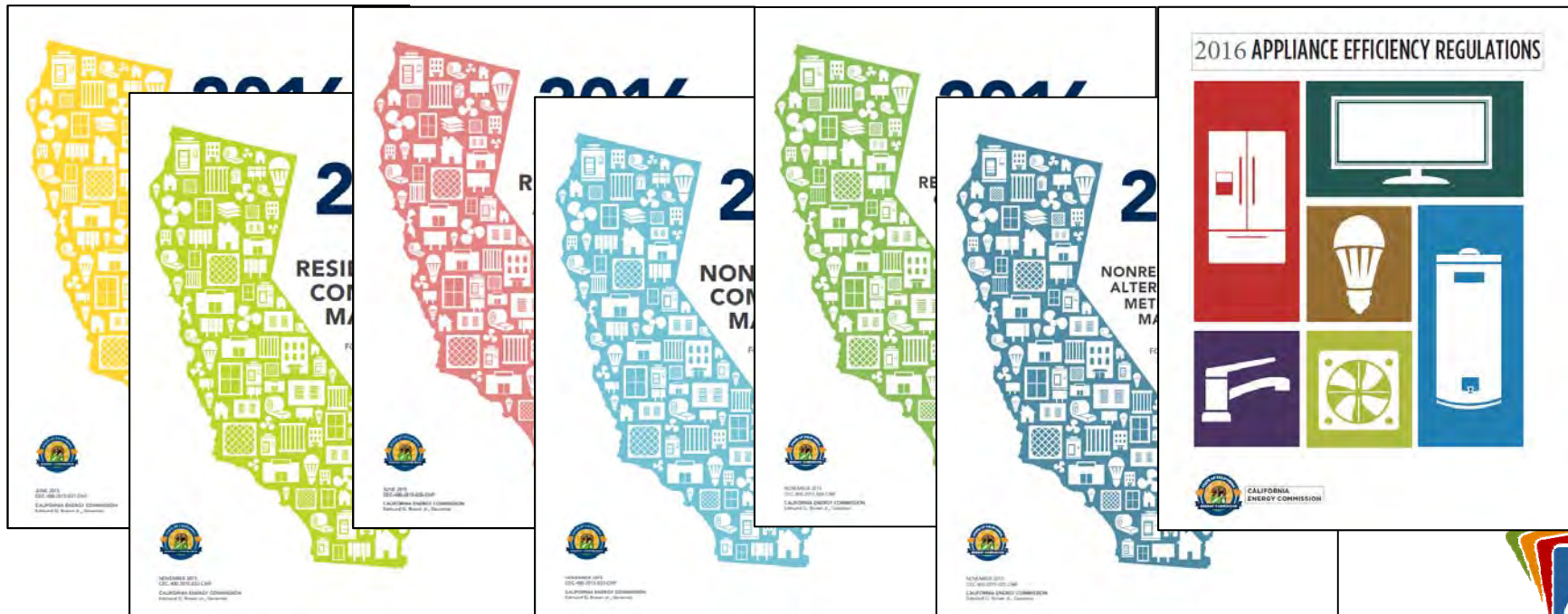
Helps you navigate the Standards using key word search capabilities, hyperlinked tables and related sections

2016 Building and Appliance Efficiency Regulations - Reference Ace v26

Contents Index Search

- 2016 BUILDING ENERGY EFFICIENCY STANDARDS
- REFERENCE APPENDICES
- RESIDENTIAL COMPLIANCE MANUAL
- RESIDENTIAL ACM REFERENCE MANUAL
- NONRESIDENTIAL COMPLIANCE MANUAL
- NONRESIDENTIAL ACM REFERENCE MANUAL
- TITLE 20 APPLIANCE EFFICIENCY REGULATIONS
- TITLE 20 APPLIANCE EFFICIENCY REGULATIONS (Appliance-Specific Sections Only)

2016 Building Energy Efficiency Standards and Title 20 Appliance Efficiency Regulations Reference Ace Tool



EnergyCodeAce.com/tools





Decoding Talk: HERS Measures

Decoding 2016 HERS™
Let's Talk Residential & Nonresidential HERS Measures

When Is HERS Required?

When is HERS NOT required for Residential?

Alterations & Additions ≤ 1,000 ft²:

- a) When there are no changes and additions to a ducted HVAC system. Examples include:
 - i) Adding a ductless wall furnace
 - ii) Extending < 40 linear ft. of ducting to an existing HVAC system
 - iii) Changing or adding a water heater
 - iv) Changing or adding lighting
 - v) Changing or replacing envelope features that are NOT to be HERS pre-verified in a performance calculation such as window replacement and reroof(s)

Note: HERS will always be required for New Construction/Additions > 1,000 ft²

• Duct sealing for ducted HVAC systems.
• Air flow and fan efficacy for ducted AC systems.
• See CF1R-PRF-01-E for other building features.

of ducts outside of conditioned space.
Yes
HERS required if duct sealing is listed on NRCC-PRF-01-E.

When is HERS NOT required for Residential?

Alterations & Additions ≤ 1,000 ft²:

- a) When there are no changes and additions to a ducted HVAC system. Examples include:
 - i) Adding a ductless wall furnace
 - ii) Extending < 40 linear ft. of ducting to an existing HVAC system
 - iii) Changing or adding a water heater
 - iv) Changing or adding lighting
 - v) Changing or replacing envelope features that are NOT to be HERS pre-verified in a performance calculation such as window replacement and reroof(s)

Note: HERS will always be required for New Construction/Additions > 1,000 ft²



For more information, check out...
www.energycodeace.com

Trigger Sheet(s): Residential HVAC Alterations 2016 / Nonresidential New HVAC: Simple and Complex Systems 2016.
Factsheet: Just the Basics: HERS for Residential and Nonresidential Projects 2016.
Application Guide(s): 2016 Residential HVAC and Plumbing / 2016 Nonresidential HVAC and Plumbing.

PERFORMANCE	REFERENCE APPENDICES
CF1R-PRF-01-E	RA3.1.4.3
CF1R-PRF-01-E	Res ACM
CF1R-PRF-01-E	RA3.1.4.3.9
CF1R-PRF-01-E	RA3.3
CF1R-PRF-01-E	RA3.3
CF1R-PRF-01-E	RA3.3
CF1R-PRF-01-E	RA3.2
CF1R-PRF-01-E	RA1.2
CF1R-PRF-01-E	RA3.4.2
Res ACM 2.4.6.6, 2.4.6.7, 2.4.6.10	RA3.1.41
Res ACM 2.4.6.11, 2.4.6.12	RA3.1.4.3.9
Res ACM 2.2.6	RA3.5
Res ACM 2.3.3.2	RA3.5.6
Res ACM 2.10.3	Res Manual App. G
NonRes ACM 5.9.1.4	
Res ACM 2.9	RA3.6.3
Res ACM 2.9	RA3.6.4
NonRes ACM 5.7.3.6	NA1, NA2.1 New: 6% Altered: 15% or smoke test



Quick reference component-by-component summaries of sections of Title 24, Part 6 "triggered" based on project scope.

2016 ENERGY CODE



Residential
HVAC – Alterations

Split Systems and Packaged Systems

Change This (and nothing else)	Mandatory Requirements					Prescriptive Requirements	
	Setback Thermostat §110.2(c), §160.2(b)1F	Cooling Load Calcs §150.0(h), §160.2(b)1C	Heating Load Calcs §150.0(h), §160.2(b)1C	HERS: Duct Seal and Test §150.0(m)1-3 & 11 §160.2(b)1C, D, & E	Air Filtration and HERS: Cooling Coil Airflow and Fan Watt Draw §160.2 (b)1C, D	Duct Insulation §160.2(b)1D	HERS: Refrigerant Charge §160.2(b)1F
Whole Split or Packaged System (no ducts added or replaced)	YES	no	no ^c	YES ^d	no	no	YES ^{k,1}
Evaporator Coil (cooling coil), Condenser Coil, or Outdoor Condensing Unit	YES	no	no ^c	YES ^d	no	no	YES ^{k,1}
Furnace (air handler)	YES	no	no ^c	YES ^d	no	no	YES ^{k,1}
Compressor, Refrigerant Metering Device	YES	no	no ^c	no	no	no	YES ^{k,1}
Some Ducts > 40 feet of new or replacement	no	maybe ^b	maybe ^{c, b}	YES ^e	no	YES ^e	no
All New Ducts ^a	no	maybe ^b	maybe ^{c, b}	YES ^e	YES ^f	YES ^e	no
Whole Split or Packaged System and All New Ducts	YES	YES ^b	YES ^{c, b}	YES ^e	YES ^f	YES ^e	YES ^{k,1}

Note:

- Replacing the blower wheel fan is considered a repair and does NOT trigger the Energy Standards.
- All new HVAC equipment must meet minimum federal efficiency requirements
- Cooling line insulation is triggered if the line set (cooling system, suction line) is replaced or repaired. Line sets ≤ 1.5" in diameter must have 0.75" thick insulation.





2016 ENERGY CODE

Title 24, Part 6
Fact Sheet

**Residential and Nonresidential
Just the Basics: HERS**

What is HERS?

HERS stands for Home Energy Rating System, and is a program developed to address poor construction quality and equipment installation. In the 2016 Building Energy Efficiency Standards (Energy Standards) technologies and systems that trigger HERS verification are considered "HERS measures." These cover HVAC systems, ductwork, ventilation, plumbing and insulation for residential projects, and ductwork for nonresidential projects. In order to verify these HERS measures, certified HERS Raters perform onsite inspections and tests, to ensure proper installation and code compliance.

Type of projects requiring HERS verification:

- Residential, multifamily, and nonresidential (newly constructed buildings, and additions and alterations)
- New Solar Homes Partnership Program (newly constructed residential buildings)
- Those pursuing a California Whole-House Home Energy Rating

The Forms Ace tool is useful in determining if any HERS verification measures and forms apply to a specific project or scenario.

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 Standards. The HERS verification process ensures that the proposed HERS measures are installed and meet code compliance.

Who Does What?

HERS Raters have been trained and certified by a HERS Provider to verify compliance of HERS measures with California's Energy Standards. 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 third-party 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. Each HERS Provider reports registry data to the Energy Commission on an annual basis so the State can benchmark energy savings measures.

HERS Rater vs. Building Inspector
HERS Raters perform inspections and field verification for HERS measures. These are measures that need more in depth knowledge and usually require special testing equipment to verify the systems installed are working as designed. HERS Raters have been specifically trained and certified to perform this work. HERS Raters are similar to special inspectors and verify compliance on behalf of the building owner.

Building Inspectors perform inspections for all Building Codes (Structural, Electrical, Plumbing, etc.) during set times throughout construction.

Find a HERS Rater
Contact a HERS Provider listed on the California Energy Commission's HERS Providers page to find a local HERS Rater. Many HERS Providers have regional search capabilities on their websites.





Project Status Report

HERS Providers

CalCERTS

CHEERS

Project Status Report CalCERTS, Inc. 2 of 2
Effective: 07/10/2017 14:20

System 1: CF2R-MCH-23-H

217-P010228255A-000-001-M2002A-0000
217-P010228255A-000-002-M2002A-0000
217-P010228255A-000-003-M2002A-0000
217-P010228255A-000-004-M2002A-0000
217-P010228255A-000-005-M2002A-0000
217-P010228255A-000-006-M2002A-0000
217-P010228255A-000-007-M2002A-0000
217-P010228255A-000-008-M2002A-0000
217-P010228255A-000-009-M2002A-0000
217-P010228255A-000-010-M2002A-0000

2016 Residential Compliance HERS Provider: CalCERTS, Inc. Dec 2015

2016 Residential Compliance HERS Provider: CalCERTS, Inc. Dec 2015

CA Building Energy Efficiency Standards 2016 Residential Compliance HERS Provider: CalCERTS, Inc. Dec 2015

Project Status Report CalCERTS, Inc. 1 of 2
Effective: 07/10/2017 14:20

GENERAL INFORMATION

Energy Standards Code Year: 2016
Project Name: With QEI Decoding Sample
Project Type: New Construction SFR
Address: 15555 Jackson Rd
City / State / Zip: Stockton / CA / 95202
Enforcement Agency: City of Stockton
Permit Number: BP2016-0002

Easy to Verify @ calcerts.com

HERS VERIFIABLE MEASURES NOT COMPLETE
OVERALL STATUS NOT COMPLETE

CF1R INFORMATION - Certificate of Compliance (Documents the required energy measures)
Certificate Type: Compliance
Registered Form: CF1R-PHF-01
Registered Date: 07/06/2017 11:18
Registration Number: 217-P010228255A-000-000-00000000-0000

ADDITIONAL CF1RS

System	System Name	Registered Date	Registration Number
	CF1R-SRA-01 (Solar Ready Area)		
	CF1R-SR-02 (Minimum Solar Zone Area Workflows)		
	CF1R-SFR-01 (OG 300 SWNW)		
	CF1R-SFR-02 (OG 100 SWNW)		

CF2R INFORMATION - Certificate of Installation (Documents the proper installation of required energy measures)

System	System Name	Registered Date	Registration Number
	CF2R-ENV-01-E (Fenestration Installation)	217-P010228255A-000-001-E01001A-0000	
	CF2R-ENV-03-E (Insulation Installation)	217-P010228255A-000-001-E03001A-0000	
	CF2R-ENV-04-E (Roofing-Weather Barrier)	217-P010228255A-000-001-E04001A-0000	
	CF2R-ENV-21-H (QI-AIS-Batt, Loose Fill, and SPF)		
	CF2R-ENV-22-H (QI-Air Infiltration Sealing)	217-P010228255A-000-001-E22001A-0000	
	CF2R-ENV-23-H (QI-Insulation)		
	CF2R-MCH-01-E (Space Conditioning Systems, Ducts and Fans)	217-P010228255A-000-001-M01001A-0000	
	CF2R-MCH-02-E (Whole House Fan)	217-P010228255A-000-001-M02001A-0000	
	System 1: CF2R-MCH-20-H (Duct Leakage)	217-P010228255A-000-001-M20002A-0000	

Project Status Report CHEERS
5757 Pacific Ave, Ste 220
Oakland, CA 94605
1-800-949-2377

Builder: AA Builder Company
Project: Decoding Talk Heights
Site: 123 Green St
Address: 123 Green St
City: Pleasantville
Zip: 95368

Permit Number: 1234-5
Enforcement Agency: Sacramento (City of)
Overall Status: Incomplete
HERS Verifiable Measure Status: Incomplete

Performance Certificate of Compliance (CF1R)

Dwelling	System	Document	Title	Rev	Registered	Registration #	Registration Date
		CF1R-PPF-01-E	Performance Compliance	1	Yes	PPF17-00214675	6/26/2017 1:17:01 PM

Certificate of Installation (CF2R)

Dwelling	System	Document	Title	Rev	Pass	Registered	Registration #	Registration Date
01: Single Family Dwelling		CF2R-ENV-21-H	QEI	1	Yes	Yes	PPF17-00214675-001-000-021000A-0000	7/11/2017 9:20:57 PM
01: Single Family Dwelling		CF2R-ENV-22-H	QEI	1	Yes	Yes	PPF17-00214675-001-000-P23000A-0000	7/11/2017 5:21:11 PM
01: Single Family Dwelling		CF2R-LTG-01-E	Lighting	1	Yes	Yes	PPF17-00214675-001-000-L01000A-0000	7/11/2017 5:20:41 PM
01: Single Family Dwelling		CF2R-MCH-01a-E	HVAC, Ducts and Fans	1	No	No		
01: Single Family Dwelling		CF2R-MCH-02-E	Whole House Fan	1	Yes	Yes	PPF17-00214675-001-000-M02000A-0000	7/11/2017 5:22:58 PM
01: Single Family Dwelling		CF2R-MCH-27a-H	Mechanical Ventilation	1	No	No		

Certificate of Verification (CF3R)



Dwelling	System	Document	Title	Rev	Pass	Registered	Registration #	Registration Date
01: Single Family Dwelling		CF3R-ENV-21-H	QEI	1	No	No		
01: Single Family Dwelling		CF3R-ENV-22-H	QEI	1	No	No		




Project Status Report

How do I get IT from CalCERTS??

Building Inspector


 **PROJECT STATUS REPORT**  [Send Message to Responsible Company](#)

GENERAL INFORMATION	
Energy Standards Code Year:	2016
Project Name:	With QII Decoding Sample
Project Type:	New Construction SFR
Address:	15555 Jackson Rd
City / State / Zip:	Stockton / CA / 95202
Enforcement Agency:	City of Stockton
Permit Number:	BP2016-0001



Easy to Verify @ calcerts.com

HERS VERIFIABLE MEASURES:	NOT COMPLETE
OVERALL STATUS:	NOT COMPLETE

CF1R INFORMATION - Certificate of Compliance (Lists Required Energy Features)		✓
Certificate Type:	Compliance	
Registered Form:	CF1R-PRF-01	
Registered Date:	07/06/2017 11:18	
Registration Number:	217-P010228255A-000-000-0000000-0000	
PDF:		

ADDITIONAL CF1Rs			
System	Form	Registered Date	Registration Number



Project Status Report

How do I get IT from CalCERTS??

Contractor/Energy Consultant

Project Status Report		CalCERTS, Inc	
Effective: 07/10/2017 14:20		1 of 2	
GENERAL INFORMATION			
Energy Standards Code Year:	2016	 <p>Easy to Verify @ calcerts.com</p>	
Project Name:	With QII Decoding Sample		
Project Type:	New Construction SFR		
Address:	15555 Jackson Rd		
City / State / Zip:	Stockton / CA / 95202		
Enforcement Agency:	City of Stockton		
Permit Number:	BP2016-0001		
HERS VERIFIABLE MEASURES:	NOT COMPLETE		
OVERALL STATUS:	NOT COMPLETE		
CF1R INFORMATION - Certificates of Compliance (Links Required Energy Features)			
Certificate Type:	Compliance		
Registered Form:	CF1R-PRF-01		
Registered Date:	07/06/2017 11:18		
Registration Number:	217-P010228255A-000-000-0000000-0000		
ADDITIONAL CF1Rs			
System	Form	Registered Date	Registration Number
	CF1R-SRA-01 (Solar Ready Area)		
	CF1R-SIA-02 (Minimum Solar Zone Area Worksheet)		
	CF1R-STH-01 (OG 300 SWHW)		
	CF1R-STH-02 (OG 100 SWHW)		
CF2R INFORMATION - Certificates of Installation (Documents the proper installation of required energy features)			
System	Form	Registered Date	Registration Number
	CF2R-ENV-01-E (Fenestration Installation)		217-P010228255A-000-001-E01001A-0000
	CF2R-ENV-03-E (Insulation Installation)		217-P010228255A-000-001-E03001A-0000
	CF2R-ENV-04-E (Roofing-Radiant Barrier)		217-P010228255A-000-001-E04001A-0000
	CF2R-ENV-21-H (QII-AIS-Batt, Loose Fill, and SPF)		
	CF2R-ENV-22-H (QII-Air Infiltration Sealing)		217-P010228255A-000-001-E22001A-0000
	CF2R-ENV-23-H (QII-Installation)		
	CF2R-MCH-01-E (Space Conditioning Systems, Ducts and Fans)		217-P010228255A-000-001-M01001A-0000
	CF2R-MCH-02-E (Whole House Fan)		217-P010228255A-000-001-M02001A-0000
System 1	CF2R-MCH-20-H (Duct Leakage)		217-P010228255A-000-001-M20002A-0000

CA Building Energy Efficiency Standards 2016 Residential Compliance HERS Provider: CalCERTS Inc. Dec. 2015

Project Status Report		CalCERTS, Inc	
Effective: 07/10/2017 14:20		2 of 2	
System 1	CF2R-MCH-23-H (Airflow)		217-P010228255A-000-001-M23002A-0000
System 1	CF2R-MCH-25-H (Refrigerant Charge)		217-P010228255A-000-001-M25002A-0000
System 1	CF2R-MCH-26-H (Rated Equipment)		217-P010228255A-000-001-M26002A-0000
	CF2R-MCH-27-H (IAQ and MV)		217-P010228255A-000-001-M27001A-0000
	CF2R-PLB-01-E (Lighting)		217-P010228255A-000-001-L01001A-0000
	CF2R-PLB-02-E (SD HWS Distribution)		217-P010228255A-000-001-B02003A-0000
CF2R INFORMATION - Certificates of Verification (Documents the verification of HERS Measures)			
System	Form	Registered Date	Registration Number
	CF3R-ENV-21-H (QII-AIS-Batt, Loose Fill, and SPF)		
	CF3R-ENV-22-H (QII-Air Infiltration Sealing)		
	CF3R-ENV-23-H (QII-Installation)		
System 1	CF3R-MCH-20-H (Duct Leakage)		
System 1	CF3R-MCH-23-H (Airflow)		
System 1	CF3R-MCH-25-H (Refrigerant Charge)		
System 1	CF3R-MCH-26-H (Rated Equipment)		
	CF3R-MCH-27-H (IAQ and MV)		

CA Building Energy Efficiency Standards 2016 Residential Compliance HERS Provider: CalCERTS Inc. Dec. 2015




Project Status Report

How do I get IT from CHEERS??

Both Building Inspector and Contractor/Energy Consultant

Project Status Report

Builder: AA Builder Company
Project: Decoding Talk Heights



5757 Pacific Ave, Ste 220
Stockton, CA 97005
1-800-424-3377

Site: 123 Green St	Permit Number: 1234-5
Address: 123 Green St	Enforcement Agency: Sacramento (City of)
City: Pleasantville	Overall Status: Incomplete
Zip: 95368	HERS Verifiable Measure Status: Incomplete

Performance Certificate of Compliance (CF1R)

Dwelling	System	Document	Title	Rev	Registered	Registration #	Registration Date
		CF1R-PRF-01-E	Performance Compliance	1	Yes	PRF17-00214675	6/26/2017 1:17:01 PM

Certificate of Installation (CF2R)

Dwelling	System	Document	Title	Rev	Pass	Registered	Registration #	Registration Date
01: Single Family Dwelling		CF2R-ENV-21-H	QII	1	Yes	Yes	PRF17-00214675-001-000-E21000A-0000	7/11/2017 5:20:57 PM
01: Single Family Dwelling		CF2R-ENV-22-H	QII	1	Yes	Yes	PRF17-00214675-001-000-F22000A-0000	7/11/2017 5:21:11 PM
01: Single Family Dwelling		CF2R-ENV-23-H	QII	1	No	No		
01: Single Family Dwelling		CF2R-LTG-01-E	Lighting	1	Yes	Yes	PRF17-00214675-001-000-L01000A-0000	7/11/2017 5:20:41 PM
01: Single Family Dwelling		CF2R-MCH-01a-E	HVAC, Ducts and Fans	1	No	No		
01: Single Family Dwelling		CF2R-MCH-02-E	Whole House Fan	1	Yes	Yes	PRF17-00214675-001-000-M02000A-0000	7/11/2017 5:22:54 PM
01: Single Family Dwelling		CF2R-MCH-27a-H	Mechanical Ventilation	1	No	No		

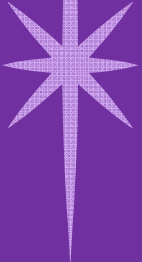
Certificate of Verification (CF3R)

Dwelling	System	Document	Title	Rev	Pass	Registered	Registration #	Registration Date
01: Single Family Dwelling		CF3R-ENV-21-H	QII	1	No	No		
01: Single Family Dwelling		CF3R-ENV-22-H	QII	1	No	No		

18



Our Question To You

- 
1. *What is your biggest challenge regarding HERS measures?*
 2. *Do you have a tool, practice or tip to share that helps insure a successful field verification of HERS measures?*
 3. *What are your top 3 concerns regarding HERS measures?*
 4. *If you could wave your magic wand, the HERS measures/process would include _____ to make your job easier?*

HERS Rater Tip:

Yes, I go over the T24 documents the first field visit. Mainly so the contractor is aware that the plans exist. And, to go over any differences between the T24 pages and the architectural (insulation values, water heater type, etc.)

Challenge:

Understanding and knowing what measures are available and that must be used/applicable to projects.

Magic Wand:

Comprehensive measures training for installers. After all these years I still find installers who don't know the codes.



Let's Talk



HELPING YOU PLAY YOUR CARDS RIGHT



Challenges



- ✦ Challenge A:
 - ✦ Residential Mandatory HERS Measures



- ✦ Challenge B:
 - ✦ Residential Prescriptive/Performance HERS Measures



- ✦ Challenge C:
 - ✦ Nonresidential Prescriptive/Performance HERS Measures



- ✦ Challenge D:
 - ✦ HERS Sampling



Forms

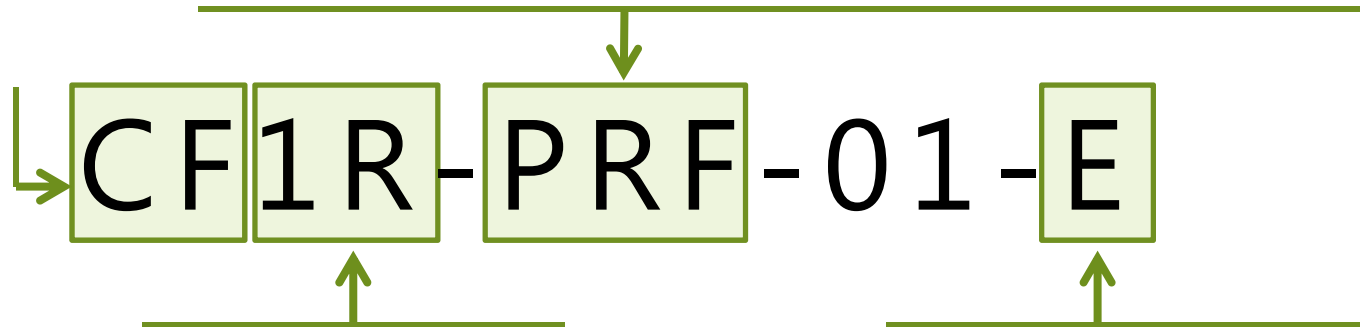
When any HERS measure has been triggered, ALL the forms must be registered with HERS provider.

Document Category

PRF = Performance approach
NCB = New construction & additions >1,000 ft²
ADD = Additions (≤ 1,000 ft²)
ALT = Alterations

ENV = Envelope
EXC = Existing Condition
MCH = Mechanical
LTG = Lighting
PLB = Plumbing (DHW)
SPV = Photovoltaic
SRA = Solar Ready
STH = Solar Hot Water
WKS = Worksheet

(Residential)
Compliance Form



Document Type

Certificates of...

1R = Compliance
2R = Installation
3R = HERS Verification

Primary user

E = Enforcement agency
H = HERS



Challenge A





Mandatory Measures



*Cannot be traded via the Performance Approach.
Not typically documented within Certificate of Compliance (CF1R)*

Two Ways to Comply with the Standards

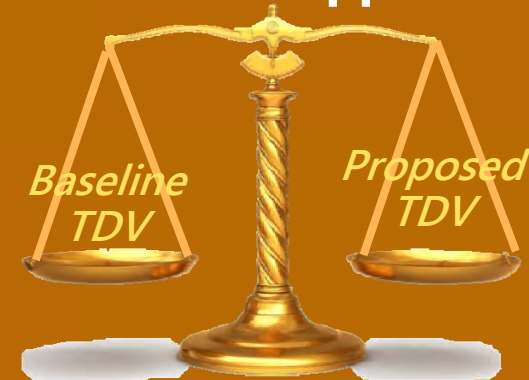


Prescriptive Approach



Each building feature to show compliance independently

Performance Approach



Proposed TDV equal or better than baseline TDV

Compliance Documentation



Decoding Talk: HERS Measures (Pg 1)



Decoding 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
DUCT MEASURES CF1R-PRF-01-E							
DUCT SEALING	Field verification and diagnostic testing to verify approved duct system materials are utilized, and that duct leakage passes.	When ducting	Altered HVAC w/ > 25 ft. ducting repair or replacement of ducting	CF2R/CF3R-MCH-20-H \$150.0(m)11			RA3.1.4.3 Single Family: New: 5% Altered: 15% Multifamily: New: 6% Altered: 15%
RETURN DUCT DESIGN	Confirm that the return duct design conform to the criteria per given §150.0(m)13; or Cooling System Airflow verification.		Altered system	CF2R/CF3R-MCH-28-H \$150.0(m)13			RA3.1.4.4
AIR FILTER DEVICE	Confirm that the air filter devices conform §150.0(m)12.		Altered system	CF2R/CF3R-MCH-28-H \$150.0(m)12			RA3.1.4.5
ZONALLY CONTROLLED CENTRAL FAN (BYPASS DUCT)	Zonally controlled systems comply with the bypass duct requirements in §150.1(c)13. Performance penalty if bypass ducts used.		New ducting, new HVAC	CF2R/CF3R-MCH-22/25-H \$150.0(m)13	Not Allowed §150.16(j)3	Res ACM 2.4.8.4	RA3.1.4.6
DUCTS IN DIRECTLY CONDITIONED SPACE	Duct system location shall be verified.	New ducted system	Altered system with > 75% new ducting, new HVAC when used in a performance calculation (CF1R-PRF-01-E)		CF2R/CF3R-MCH-20/21-H HPA Option C §150.10/99	Res ACM 2.4.6.2	RA3.1.4.3.8
LOW LEAKAGE DUCTS CONDITIONED SPACE	Field Verification for ducts in conditioned space is required. Duct sealing is required.					2.4.6.13	
DUCT SURFACE AREA/ R-VALUE, 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.					Res ACM 2.4.6.6 2.4.6.7 2.4.6.10	RA3.1.41
LOW LEAKAGE AIR-HANDLING UNITS	Verification of a factory sealed air handling unit tested by the manufacturer and certified. Duct Sealing is required.					Res ACM 2.4.6.11 2.4.6.12	RA3.1.4.3.9
AIR CONDITIONING MEASURES CF1R-PRF-01-E							
COOLING SYSTEM AIRFLOW	System airflow greater than or equal to a specified criterion, field verification and diagnostic testing required.		Altered ducted system with AC	CF2R/CF3R-MCH-23-H \$150.0(m)13			RA3.3
COOLING AIR-HANDLING UNIT FAN EFFICACY	Fan efficacy (Watt/cfm) less than or equal to a specified criterion, field verification and diagnostic testing required.		New AC System in CZ 2, 8-15	CF2R/CF3R-MCH-22-H \$150.0(m)13			RA3.3
REFRIGERANT CHARGE	Air-cooled air conditioners and air-source heat pumps diagnostically tested to verify that the system has the correct refrigerant charge.		Altered AC System in CZ 2, 8-15		CF2R/CF3R-MCH-25-H Climate Zone 2, 8-15 §150.10(7A)	Credit in Climate Zone 1, 3-7, 16 Res ACM 2.4.5.1	RA3.3 RA3.2 RA1.2
FAULT INDICATOR DISPLAY	Fault Indicator Display can be installed as an alternative to refrigerant charge testing. Field verification is required.						RA3.4.2

◆ Ducts

- ◆ Duct Testing
- ◆ Cooling Coil Airflow
 - or return grille design
 - w/Air Filter Device
- ◆ Zonally controlled systems

◆ AC Systems

- ◆ Cooling Coil Airflow
 - or return grille design
- ◆ Fan Efficacy



Decoding Talk: HERS Measures (Pg 2)



Decoding 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
AIR CONDITIONING MEASURES (CF1R-PRF-01-E)							
ENERGY EFFICIENCY RATIO (EER)	Compliance credit for increased EER by installation of specific air conditioner or heat pump models. Does not apply to equipment rated only with an EER.	New AC System	Altered AC system when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.4.5.4	RA3.4.3 RA3.4.4.1
SEASONAL ENERGY EFFICIENCY RATIO (SEER)	Compliance credit for increased SEER by installation of specific air conditioner or heat pump models.			Res ACM 2.4.5.5	RA3.4.3 RA3.4.4.1		
EVAPORATIVELY COOLED CONDENSERS	Compliance credit for installation of evaporatively cooled condensers. Duct leakage and refrigerant charge is required.			Res ACM 2.4.5.6 2.4.5.7	RA3.1.4.3; 3.2 RA3.4.3/4.1		
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.	Addition		CF2R/CF3R-MCH-27-H \$150.00(o)			RA3.7.4.1 RA3.7.4.2
BUILDING ENVELOPE MEASURES							
BUILDING ENVELOPE AIR LEAKAGE	Compliance credit can be taken for reduced building envelope air leakage.	New Homes	N/A			Res ACM 2.2.5.1	RA3.8
HIGH QUALITY INSULATION INSTALLATION (QII)	Compliance credit can be taken for quality installation of insulation.		Addition only if present in CF1R-PRF			Res ACM 2.2.6	RA3.5
SPRAY POLYURETHANE FOAM (SPF) INSULATION	Verify the installation of SPF insulation whenever R-values other than the default R-value per inch are used for compliance credit.		Altered Envelope Features if present in CF1R-PRF	MANDATORY	PRESCRIPTIVE	PERFORMANCE	Res ACM 2.3.3.2
SINGLE FAMILY DOMESTIC HOT WATER MEASURES (CF1R-PRF-01-E)							
PIPE INSULATION CREDIT	Inspection to verify that all hot water piping in non-recirculating systems is insulated and that corners and tees are fully insulated. No piping should be visible due to insulation voids with the exception of the last segment of piping that penetrate walls and delivers hot water to the sink, appliance, etc.	New Homes	New HW Distribution System when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.9	RA3.6.3
PARALLEL PIPING	Inspection that requires that the measured length of piping between the water heater and single central manifold does not exceed five feet.			Res ACM 2.9	RA3.6.4		

✦ Ventilation

✦ IAQ

- Continuous or intermittent

✦ Central Fan Integration



Ducts



Duct Testing

- ✦ Section 150.0(m)11
 - ✦ New ducted HVAC systems
 - ✦ Adding >40 ft. of ducting to existing system



Description	Procedure
Verify that duct leakage is less than or equal to the compliance criteria of applicable building, system, or phase of construction.	RA3.1.4.3

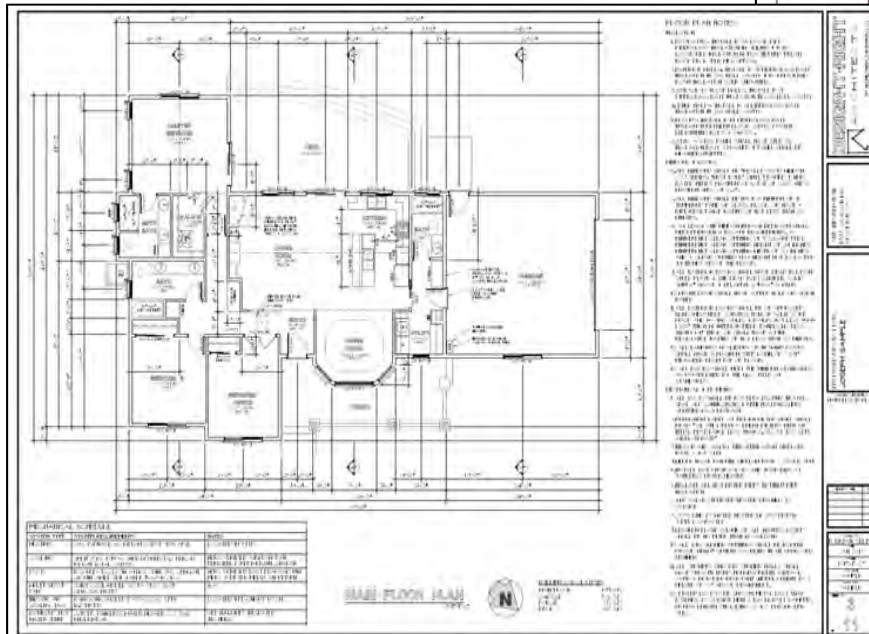


Duct Testing



Design Phase

- Review CF1R for information
- Do the plans provide guidance?



CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD

Project Name: Sample House Calculation Date/Time: 14:36, Thu, Feb 02, 2017 CF1R-PRF 01
 Calculation Description: Title 24 Analysis Input File Name: Sample T24 v7 01282017.rbd16x Page 8 of 10

HVAC COOLING - HERS VERIFICATION						
01	02	03	04	05	06	
Name	Verified Airflow	Airflow Target	Verified EER	Verified SEER	Verified Refrigerant Charge	
Cooling Component 1-hers-cool	Required	350	Required	Not Required	Required	

HVAC - DISTRIBUTION SYSTEMS						
01	02	03	04	05	06	07
Name	Type	Duct Leakage	Insulation R-value	Duct Location	Bypass Duct	HERS Verification
Air Distribution System 1	DuctsAttic	Sealed and tested	8	Attic	None	Air Distribution System 1-hers-dist

HVAC DISTRIBUTION - HERS VERIFICATION							
01	02	03	04	05	06	07	08
Name	Duct Leakage Verification	Duct Leakage Target (%)	Verified Duct Location	Verified Duct Design	Burred Ducts	Deeply Buried Ducts	Low leakage Air Handler
Air Distribution System 1-hers-dist	Required	5.0	Not Required	Not Required	Not Required	Not Required	—

HVAC - FAN SYSTEMS			
01	02	03	04
Name	Type	Fan Power (Watts/CFM)	HERS Verification
HVAC Fan 1	Single Speed PSC Furnace Fan	0.58	HVAC Fan 1-hers-fan

HERS VERIFICATION		
01	02	03
Name	Verified Fan Watt Draw	Required Fan Efficiency (Watts/CFM)
HVAC Fan 1-hers-fan	Required	0.58

FANS					
02	03	04	05	06	
IAQ CFM	IAQ Watts/CFM	IAQ Fan Type	IAQ Recovery Effectiveness(%)	HERS Verification	
48	0.25	Default	0	Required	

17-P010001003A-000-000-0000000-0000 Registration Date/Time: 2017-02-03 13:16:00 HERS Provider: CalCERTS, Inc.
 Agency Standards - 2016 Residential Compliance Report Version - CF1R 02022017-695 Report Generated at: 2017-02-02 14:37:48



Duct Testing: New



Construction Phase

- Contractor should be testing the duct system *before* or *with* the HERS rater
- Provide the appropriate **CF2R-MCH-20**
- Have duct leakage verified by HERS rater which they will document with a CF3R
- Provide CF2R/CF3Rs to the Home Owner

* Leakage to outside to verify low leakage ducts in conditioned space

Construction Type: NEW

- Single Family and Low-Rise Multi Family
 - New duct system
 - Completely new

Testing methods New

Single Family

- Duct Leakage 5%
- Leakage to outside 25 CFM

Low-Rise Multi Family

- Duct Leakage 12%
- Leakage to outside 6%

Copyright Homemade-Preschool.com



Duct Testing: Alterations



2016 ENERGY CODE



Title 24, Part 6

Residential HVAC – Alterations

Split Systems and Packaged Systems

Change This (and nothing else)	Mandatory Requirements					Prescriptive Requirements	
	Setback Thermostat §110.2(c), §150.2(b)1F	Cooling Load Calcs §150.0(h), §150.2(b)1C	Heating Load Calcs §150.0(h), §150.2(b)1C	HERS: Duct Seal and Test §150.0(m)1-3 & 11 §150.2(b)1C, D, & E	Air Filtration and HERS: Cooling Coil Airflow and Fan Watt Draw §150.2 (b)1C, D	Duct Insulation §150.2(b)1D	HERS: Refrigerant Charge §150.2(b)1F
Whole Split or Packaged System (no ducts added or replaced)	YES	no	no ^c	YES ^d	no	no	YES ^{m,1}
Evaporator Coil (cooling coil), Condenser Coil, or Outdoor Condensing Unit	YES	no	no ^c	YES ^d	no	no	YES ^{m,1}
Furnace (air handler)	YES	no	no ^c	YES ^d	no	no	YES ^{m,1}
Compressor, Refrigerant Metering Device	YES	no	no ^c	no	no	no	YES ^{m,1}
Some Ducts >40 feet of new or replacement	no	maybe ^a	maybe ^{c, b}	YES ^e	no	YES ^b	no
All New Ducts ^a	no	maybe ^a	maybe ^{c, b}	YES ^e	YES ^f	YES ^b	no
Whole Split or Packaged System and All New Ducts	YES	YES ^a	YES ^{c, b}	YES ^e	YES ^f	YES ^b	YES ^{m,1}

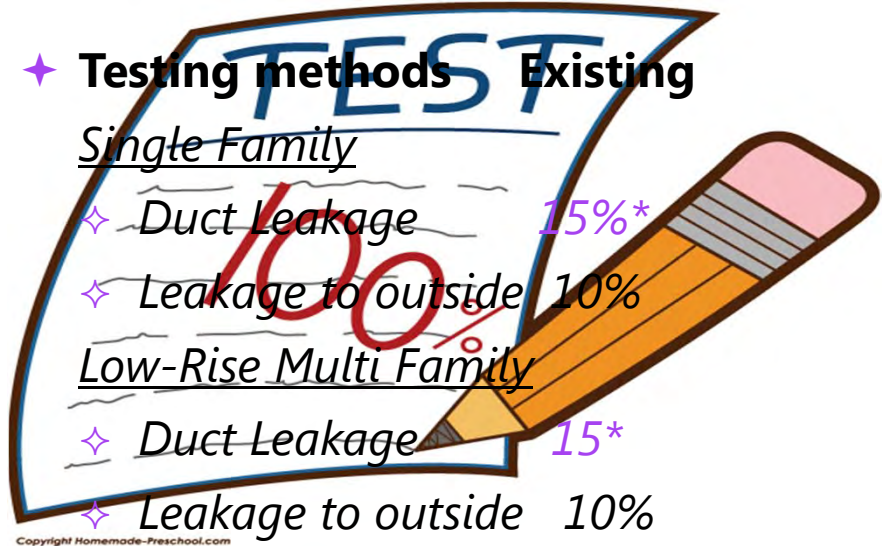
Note: • Replacing the blower wheel fan is considered a repair and does NOT trigger the Energy Standards.
 • All new HVAC equipment must meet minimum federal efficiency requirements
 • Cooling line insulation is triggered if the line set (cooling system, suction line) is replaced or repaired. Line sets ≤ 1.5" in diameter must have 0.75" thick insulation.

Testing methods Existing Single Family

✦ Duct Leakage 15%*
 ✦ Leakage to outside 10%

Low-Rise Multi Family

✦ Duct Leakage 15%*
 ✦ Leakage to outside 10%



* or.. "I did the best I can" smoke test as verified by HERS rater



AC Systems: Airflow and Fan Watt Draw



Airflow and Fan Watt Draw

- ◆ Section 150.0(m)13B and C
 - ◆ New ducted system with AC
 - ◆ Altered system with new ducting, new air handler *and* new AC
 - ◆ New ducting with existing HVAC equipment

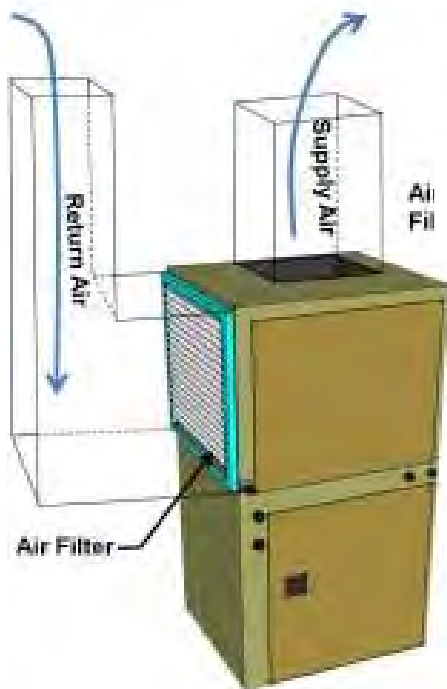


Image from Building America Solution Center

Description	Procedure
<p>Single Zone Central Forced Air Systems. Airflow: Airflow ≥ 350 CFM per ton of nominal cooling capacity through the return grilles Fan Watt Draw: Air-handling unit fan efficacy ≤ 0.58 W/CFM</p> <p><i>Exceptions:</i></p> <ol style="list-style-type: none">1. Size the return ducts per Table 150.0-C or 150.0-D and provide with MERV 6 filter as verified by HERS rater2. <i>Multispeed/variable speed compressors and Small duct high velocity systems have additional exceptions</i>	RA3.1.4.4-5 <i>or</i> RA3.3.3

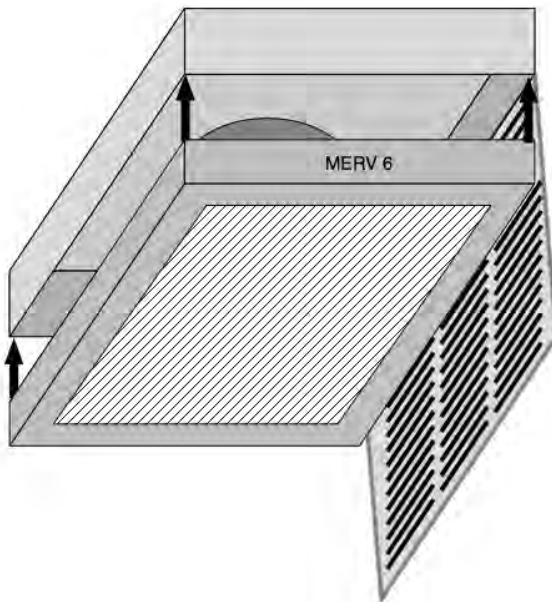


Air Filter Device



Air Filter Device

- ★ Section 150.0(m)12
 - ✦ New ducted system with AC
 - ✦ Altered system with new ducting and new air handler



Description	Procedure
<p>Verification to confirm that the air filter devices conform to the requirements given in §150.0(m)12.</p> <p>System Design and Installation to include air filter of MERV 6 with Air Filter Media Pressure Drop taken into consideration so that airflow/fan efficacy testing can be successful with the Air Filter Media Product Labeling provided.</p>	RA3.1.4.5

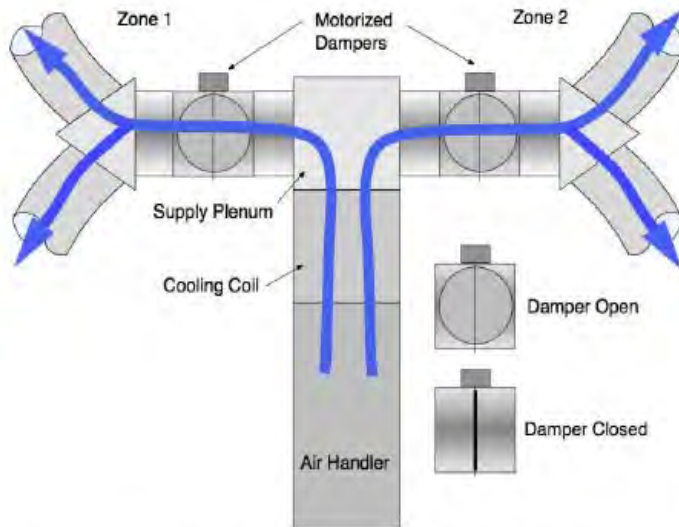


Zonally Controlled Central FAU



Zonally Controlled Central FAU

- ★ Section 150.0(m)13C
 - ✦ New central forced AC systems
 - ✦ Altered system with new ducting, new air handler *and* new AC
 - ✦ New ducting with existing HVAC equipment



This diagram shows a common two-zone, two-damper system with both zones open (i.e., both zones are calling for cooling).

Description

Zonally Controlled Central Forced Air Systems.

Simultaneously delivering, **in EVERY zonal control mode:**

Airflow: Airflow ≥ 350 CFM per ton of nominal cooling capacity through the return grilles

Fan Watt Draw: Air-handling unit fan efficacy ≤ 0.58 W/CFM

Exceptions:

1. If penalty taken in Performance CF1R, the option of airflow/fan watt draw verification at system instead of at each zonal control mode is allowed

Procedure

RA3.1.4.6

Appendix F of the Residential Manual provides further guidance



AC Systems



Design Phase

- Review CF1R for information.
- DESIGN** a system that will pass the tests
- Do the plans provide guidance?

✦ Poor Design: What can go wrong?

- ✦ Oversized equipment + Undersized ductwork
 - Reduced airflow
 - Increased fan watt draw
 - Reduced cooling capacity
 - Reduced cooling efficiency
- ✦ Poor comfort

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD CF1R-PRF-01
 Project Name: Sample House Calculation Date/Time: 19:52, Sun, Mar 15, 2017
 Calculation Description: Title 24 Analysis Input File Name: Sample T24_T7 Clr stud 16x Page 7 of 9

HVAC COOLING - HERS VERIFICATION					
01	02	03	04	05	06
Name	Verified Airflow	Airflow Target	Verified EER	Verified SEER	Verified Refrigerant Charge
Cooling Component 1 (air-cool)	Required	0.0	Required	Not Required	Required

HVAC - DISTRIBUTION SYSTEMS						
01	02	03	04	05	06	07
Name	Type	Duct Leakage	Insulation R value	Duct Location	Bypass Duct	MERS Verification
Air Distribution System 1	Duct/Crew	Sealed and tested	8	Outside space	None	Air Distribution System 1 Sealed

HVAC DISTRIBUTION - HERS VERIFICATION							
01	02	03	04	05	06	07	08
Name	Duct Leakage Verification	Duct Leakage Target (%)	Verified Duct Location	Verified Duct Design	Sealed Ducts	Directly Sealed Ducts	Low leakage Air Handler
Air Distribution System 1 (air-cool)	Required	5.0	Not Required	Not Required	Not Required	Not Required	—

HVAC - FAN SYSTEMS			
01	02	03	04
Name	Type	Fan Power (Watts/CFM)	HERS Verification
HVAC Fan 1	Single Speed PSC/Thermoplastic Fan	0.58	HVAC Fan 1 (air fan)

HVAC FAN SYSTEMS - HERS VERIFICATION		
01	02	03
Name	Verified Fan Watt Draw	Required Fan Efficiency (Watts/CFM)
HVAC Fan 1 (air fan)	Required	0.58

IAQ (Below Air Quality) FANS					
01	02	03	04	05	06
Exhaust Unit	IAQ CFM	IAQ Watts/CFM	IAQ Fan Type	IAQ Recovery Efficiency(%)	HERS Verification
3 Fan IAQ (vent)	45	0.25	Default	0	Required

Registration Number: PRF17-0021401 Registration Expiry Date: 06/26/2017 13:17
 CA Building Energy Efficiency Standards - 2016 Residential Compliance Report Version: CF1R-0202017-001 HERS Provider: CH2ERB
Report Generated at: 2017-03-15 19:01:14



AC Systems



Construction Phase

- ◆ **Install per DESIGNED duct system**
- ◆ Provide the applicable **CF2R-MCH-22 (fan watt draw) and 23 (airflow) or 28 (return grill size)**
- ◆ Have airflow/fan watt draw verified by HERS rater which they will document with a CF3R
- ◆ Provide CF2R/CF3Rs to the Home Owner

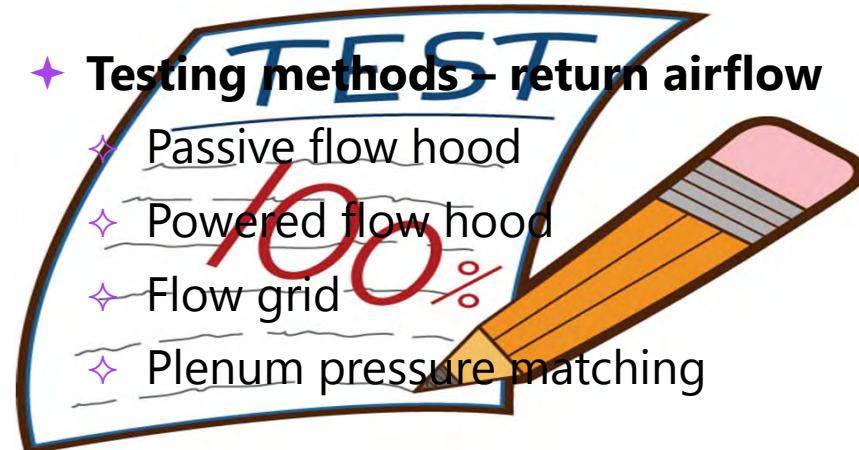
◆ **Poor Installation: What can go wrong?**

- ◆ Resistance to airflow
- ◆ Poor air balance
- ◆ Increased leakage
- ◆ Poor comfort
- ◆ High bills



◆ **Testing methods – return airflow**

- ◆ Passive flow hood
- ◆ Powered flow hood
- ◆ Flow grid
- ◆ Plenum pressure matching



Copyright Homemade-Preschool.com



Static Pressure Probe (HSPP)



Static Pressure Probe

- ◆ Section 150.0(m)13A
 - ◆ New ducted AC system
 - ◆ Altered ducted AC system

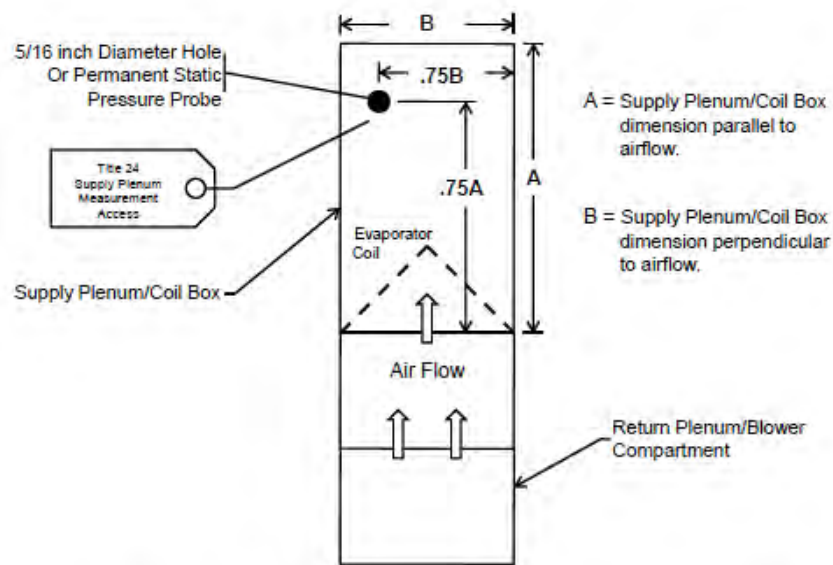


Figure RA3.3-1 Hole for the Placement of a Static Pressure Probe (HSPP) or Permanently Installed Static Pressure Probe (PSPP)

Description

When Refrigerant Charge is required then, the **Contractor** must provide:

- 5/8 inch (16 mm) diameter hole

Exceptions:

- *Return located entirely within conditioned space*
- *Systems that cannot conform to the specifications for the hole location shown. (e.g. "pancake units")*

Procedure

RA3.2.2.3



IAQ Ventilation



IAQ Ventilation

- ✦ Section 150.0(o)
 - ✦ New homes
 - ✦ Addition over 1,000 sq. ft.



Description	Procedure
Verify that whole-building ventilation system complies with the airflow rate required by ASHRAE Standard 62.2.	RA7.4.1 Continuous Operation
	RA7.4.2 Intermittent Operation



Central Fan Integrated Ventilation



Central Fan Integrated Ventilation

- ✦ Section 150.1(c)10
 - ✦ New Construction
 - ✦ Altered system with new ducting, new air handler *and* new AC

Description	Procedure
When a central FAU is used for IAQ ventilation, HERS rater will verify that the fan system meets the fan efficacy requirements AND that an intermittent ventilation control has been installed and working properly.	RA3.3 <i>Fan Efficacy Testing</i>
	RA3.7.4.2 <i>Intermittent Ventilation Controls</i>

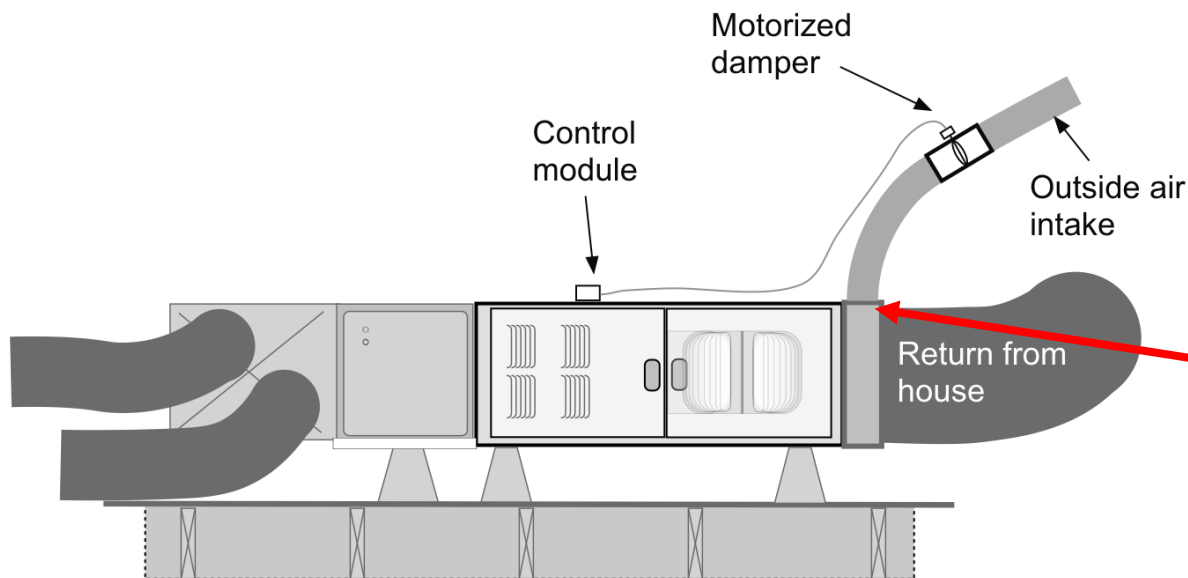


Central Fan Integrated Ventilation



Central Fan Integrated Ventilation

- ✦ Difficult to measure airflow at intake
- ✦ May increase duct leakage results
- ✦ Difficult to control accurately
- ✦ Difficult to filter incoming air



An outside air intake inside a return plenum using a motorized damper.

Diagram courtesy of CalCERTs, Inc.

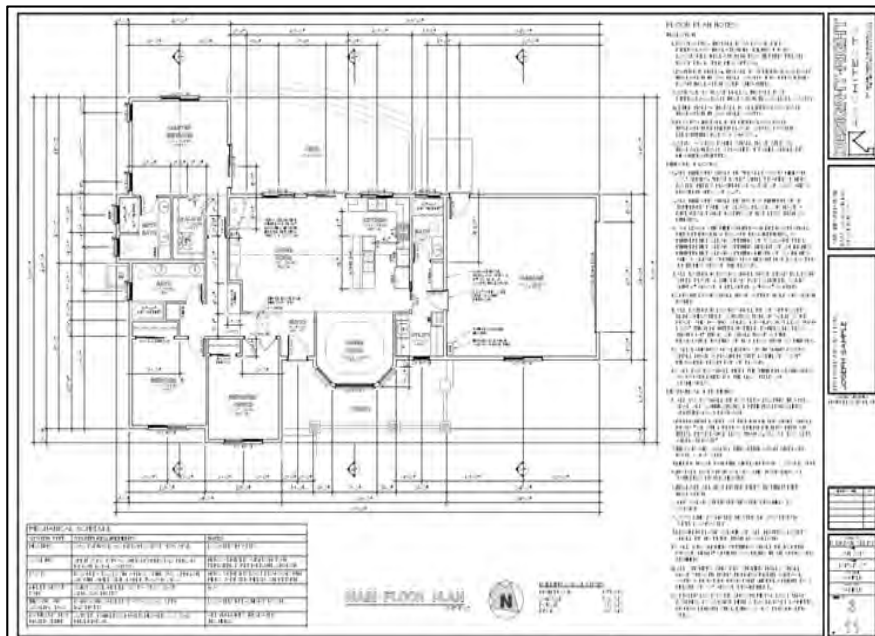


Design Phase: IAQ



Design Phase

- Review CF1R for information.
- Do the plans provide guidance?



CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD

Project Name: Sample House Calculation Date/Time: 14:36, Thu, Feb 02, 2017 CF1R PRF 01
 Calculation Description: Title 24 Analysis Input File Name: Sample T24 v7 01262017 rbd16x Page 8 of 10

HVAC COOLING - HERS VERIFICATION					
01	02	03	04	05	06
Name	Verified Airflow	Airflow Target	Verified EER	Verified SEER	Verified Refrigerant Charge
Cooling Component 1-hers-cool	Required	350	Required	Not Required	Required

HVAC - DISTRIBUTION SYSTEMS						
01	02	03	04	05	06	07
Name	Type	Duct Leakage	Insulation R-value	Duct Location	Bypass Duct	HERS Verification
Air Distribution System 1	Ducts/Attic	Sealed and tested	8	Attic	Name	Air Distribution System 1-hers-dist

HVAC DISTRIBUTION - HERS VERIFICATION							
01	02	03	04	05	06	07	08
Name	Duct Leakage Verification	Duct Leakage Target (%)	Verified Duct Location	Verified Duct Design	Blurred Ducts	Deeply Buried Ducts	Low leakage Air Handler
Air Distribution System 1-hers-dist	Required	5.0	Not Required	Not Required	Not Required	Not Required	—

HVAC - FAN SYSTEMS			
01	02	03	04
Name	Type	Fan Power (Watts/CFM)	HERS Verification
HVAC Fan 1	Single Speed PSC Furnace Fan	0.58	HVAC Fan 1-hers-fan

HVAC FAN SYSTEMS - HERS VERIFICATION		
01	02	03
Name	Verified Fan Watt Draw	Required Fan Efficiency (Watts/CFM)
HVAC Fan 1-hers-fan	Required	0.58

IAQ (Indoor Air Quality) FANS					
01	02	03	04	05	06
Dwelling Unit	IAQ CFM	IAQ Watts/CFM	IAQ Fan Type	IAQ Recovery Effectiveness(%)	HERS Verification
SF-air IAQVentrPl	48	0.25	Default	0	Required

Registration Number: 217-P010001003A-000-000-0000000-0000 Registration Date/Time: 2017-02-03 13:46:00 HERS Provider: CalCERTS, Inc.
 CA Building Energy Efficiency Standards - 2016 Residential Compliance Report Version: CF1R.02022017.695 Report Generated at: 2017-02-02 14:37:48



Construction Phase: IAQ



Construction Phase

- ✦ Install the appropriate IAQ system
- ✦ Provide the applicable **CF2R-MCH-27** for the appropriate system
- ✦ Have airflow verified by HERS rater which they will document with a CF3R
- ✦ Provide CF2R/CF3Rs to the Home Owner

✦ Fan Operation Types

- ✦ **Continuous** fan system that stays on 24 hours a day without use of controls
- ✦ **Intermittent** fan system that goes on and off throughout the day with the use of controls (require much higher airflow rate)

✦ Testing methods

- ✦ *Fan Ventilation Rate Method:*
CFM is tested at each fan identified as IAQ fan(s)
- ✦ *Total Ventilation Rate Method:*
CFM is tested with blower door test for the entire home

Copyright Homemade-Preschool.com



Challenge B

Challenge B

Residential
Prescriptive/Performance
HERS Measures



Mandatory Measures



*Cannot be traded via the Performance Approach.
Not typically documented within Certificate of Compliance (CF1R)*

Two Ways to Comply with the Standards

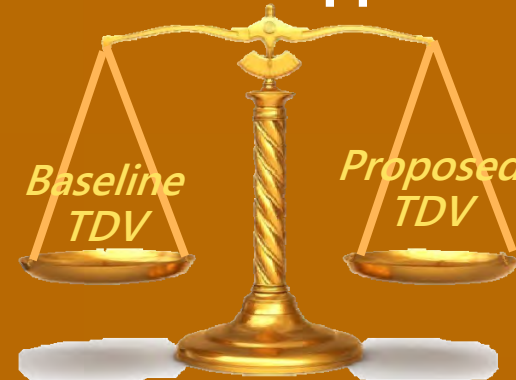


Prescriptive Approach



Each building feature to show compliance independently

Performance Approach



Proposed TDV equal or better than baseline TDV

Compliance Documentation



Decoding Talk: HERS Measures



Decoding * 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES	
		New	Altered					
DUCT MEASURES CF1R-PRF-01-E								
DUCT SEALING	Field verification and diagnostic testing to verify approved duct system materials are utilized, and that duct leakage passes.	When > 10 ft. ducting	Altered HVAC w/ > 25 ft. ducting outside conditioned space or Adding > 40 ft. of ducting	CF2R/CF3R-MCH-20-H \$150.0(m)11			RA3.1.4.3 Single Family: New: 5% Altered: 15% Multifamily: New: 5% Altered: 15%	
RETURN DUCT DESIGN	Confirm that the return duct design conform to the criteria per given §150.0(m)13; or Cooling System Airflow verification.	New ducted system	Altered system with > 75% new ducting, new HVAC	CF2R/CF3R-MCH-28-H \$150.0(m)13			RA3.1.4.4	
AIR FILTER DEVICE	Confirm that the air filter devices conform §150.0(m)12.			CF2R/CF3R-MCH-28-H \$150.0(m)12			RA3.1.4.5	
ZONALLY CONTROLLED CENTRAL FAN (BYPASS DUCT)	Zonally controlled systems comply with the bypass duct requirements in §150.1(c)13. Performance penalty if bypass ducts used.					Not Allowed- §150.1(c)13	Res ACM 2.4.8.4	RA3.1.4.6
DUCTS IN DIRECTLY CONDITIONED SPACE	Duct system location shall be verified.					CF2R/CF3R-MCH-20/21-H	Res ACM 2.4.6.2	RA3.1.4.3.8
LOW LEAKAGE DUCTS CONDITIONED SPACE	Field Verification for ducts in conditioned space is required. Duct sealing is required.					HPA Option C §150.1(c)9	2.4.6.13	
DUCT SURFACE AREA/ R-VALUE. 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.						Res ACM 2.4.6.6 2.4.6.7 2.4.6.10	RA3.1.4.1
LOW LEAKAGE AIR-HANDLING UNITS	Verification of a factory sealed air handling unit tested by the manufacturer and certified. Duct Sealing is required.				Res ACM 2.4.6.11 2.4.6.12	RA3.1.4.3.9		
AIR CONDITIONING MEASURES CF1R-PRF-01-E								
COOLING SYSTEM AIRFLOW	System airflow greater than or equal to a specified criterion, field verification and diagnostic testing required.	New ducted system with AC	Altered system with > 75% new ducting, new air handler and new AC.	CF2R/CF3R-MCH-23-H \$150.0(m)13			RA3.3	
COOLING AIR-HANDLING UNIT FAN EFFICACY	Fan efficacy (Wats/cfm) less than or equal to a specified criterion, field verification and diagnostic testing required.			CF2R/CF3R-MCH-22-H \$150.0(m)13			RA3.3	
REFRIGERANT CHARGE	Air-cooled air conditioners and air-source heat pumps diagnostically tested to verify that the system has the correct refrigerant charge.	New AC System in CZ 2, 8-15	Altered AC	CF2R/CF3R-MCH-25-H			RA3.3	
FAULT INDICATOR DISPLAY	Fault Indicator Display can be installed as an alternative to refrigerant charge testing. Field verification is required.			Climate Zone 2, 8-15 §150.1(c)7A	Credits in Climate Zone 1, 3-7, 16. Res ACM 2.4.5.1		RA3.2 RA1.2 RA3.4.2	

◆ Ducts

- ◆ Performance penalty required when Bypass Ducts used for zonally controlled systems
- ◆ When HPA option C is used, ducts must be verified that they are within the directly conditioned space

◆ AC Systems

- ◆ Refrigerant Charge



Refrigerant Charge



Refrigerant Charge



★ Section 150.1(c)7A



New systems with AC in CZ 2, 8-15



Altered AC in CZ 2, 8-15



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



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



Description

- For use for residential air-cooled air conditioners and air source heat pumps to verify the systems have the required refrigerant charge.
- For dwelling units with multiple air conditioners or heat pumps, the procedures shall be applied to each system separately.

Procedure

RA3.2.2

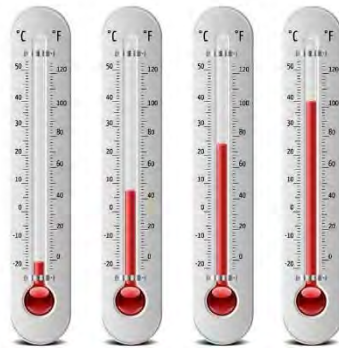
Standard Charge

RA3.2.3

Weigh-in Charging



Refrigerant Charge Methods



Standard Charge RA3.2.2

- ✦ Verification of minimum system airflow rate across the cooling coil and that metering device is operating properly.
- ✧ Outdoor air temperature is 55°F or above.

Weigh-In Charge RA3.2.1.2

- ✦ MAY be used as an alternative to the Standard Charge
- ✦ SHALL be used when the outdoor air temperature is below 55°F
- ✦ HERS raters SHALL observe HVAC installer

Charge Indicator Display RA3.2.2

- ✦ Provide real-time information to the building occupant about the status of:
 - ✧ System refrigerant charge;
 - ✧ Metering device;
 - ✧ System airflow.



Verified Ducts



Verified Ducts



- ✦ Section 150.0(m)
 - ✦ New Construction
 - ✦ Altered system with new ducting, new air handler *and* new AC



Duct Option

Ducts Located Entirely In Conditioned Space



Prescriptively required when HPA Option C selected per CF1R



No Bypass Ducts



No Bypass Ducts



★ Section 150.1(c)13



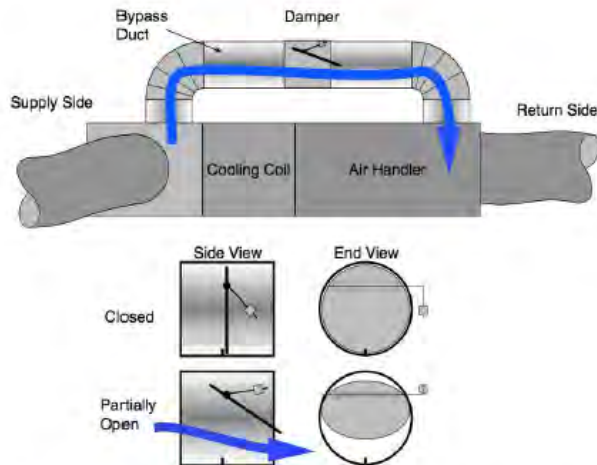
New Construction



Altered system with new ducting



Performance penalty *for using* bypass duct



This diagram shows a common bypass duct/damper strategy. The bypass duct is sheet metal (which should always be insulated) and the damper is a barometric type. The details show how the damper opens when air pressure builds up against the adjustable weight. Sending heated or cooled air back into the space conditioning equipment can cause problems and reduce efficiency.

Description	Procedure
<p>Zonally controlled FAU:</p> <ul style="list-style-type: none"> A visual inspection shall confirm that bypass ducts that deliver conditioned supply air directly to the space conditioning system return duct airflow are not used. 	<p>RA3.1.4.1.6 <i>Visual inspections</i></p>



Mandatory Measures



*Cannot be traded via the Performance Approach.
Not typically documented within Certificate of
Compliance (CF1R)*

Two Ways to Comply with the Standards



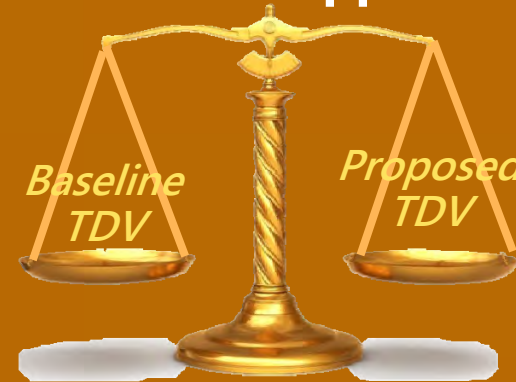
Prescriptive Approach



*Each building feature to show
compliance independently*



Performance Approach



*Proposed TDV equal or better
than baseline TDV*

Compliance Documentation



Decoding Talk: HERS Measures



Decoding * 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
DUCT MEASURES CF1R-PRF-01-E							
DUCT SEALING	Field verification and diagnostic testing to verify approved duct system materials are utilized, and that duct leakage passes.	When >10 ft. ducting	Altered HVAC w/ >25 ft. ducting outside conditioned space or Adding >40 ft. of ducting	CF2R/CF3R-MCH-20-H \$150.0(m)11			RA3.1.4.3 Single Family: New: 5% Altered: 15% Multifamily: New: 6% Altered: 15%
RETURN DUCT DESIGN	Confirm that the return duct design conform to the criteria per given §150.0(m)13; or Cooling System Airflow verification.	New ducted system	Altered system with >75% new ducting, new HVAC	CF2R/CF3R-MCH-28-H \$150.0(m)13			RA3.1.4.4
AIR FILTER DEVICE	Confirm that the air filter devices conform §150.0(m)12.			CF2R/CF3R-MCH-28-H \$150.0(m)12			RA3.1.4.5
ZONALLY CONTROLLED CENTRAL FAN (BYPASS DUCT)	Zonally controlled systems comply with the bypass duct requirements in §150.1(c)13. Performance penalty if bypass ducts used.			Not Allowed. §150.1(c)13	Res ACM 2.4.8.4	RA3.1.4.6	
DUCTS IN DIRECTLY CONDITIONED SPACE	Duct system location shall be verified.			CF2R/CF3R-MCH-28-H \$150.0(m)13	Res ACM 2.4.6.2	RA3.1.4.3.8	
LOW LEAKAGE DUCTS CONDITIONED SPACE	Field Verification for ducts in conditioned space is required. Duct sealing is required.			Res ACM 2.4.6.13			
DUCT SURFACE AREA/ R-VALUE. 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.			Res ACM 2.4.6.6 2.4.6.7 2.4.6.10	RA3.1.4.1		
LOW LEAKAGE AIR-HANDLING UNITS	Verification of a factory sealed air handling unit tested by the manufacturer and certified. Duct Sealing is required.			Res ACM 2.4.6.11 2.4.6.12	RA3.1.4.3.9		
AIR CONDITIONING MEASURES CF1R-PRF-01-E							
COOLING SYSTEM AIRFLOW	System airflow greater than or equal to a specified criterion, field verification and diagnostic testing required.	New ducted system with AC	Altered system with >75% new ducting, new air handler and new AC.	CF2R/CF3R-MCH-23-H \$150.0(m)13			RA3.3
COOLING AIR-HANDLING UNIT FAN EFFICACY	Fan efficacy (Watt/cfm) less than or equal to a specified criterion, field verification and diagnostic testing required.			CF2R/CF3R-MCH-22-H \$150.0(m)13			RA3.3
REFRIGERANT CHARGE	Air-cooled air conditioners and air-source heat pumps diagnostically tested to verify that the system has the correct refrigerant charge.	New AC System in CZ 2, 8-15	Altered AC System in CZ 2, 8-15		CF2R/CF3R-MCH-25-H \$150.1(c)7A	Credit in Climate Zone 1-3-7,16 Res ACM 2.4.5.1	RA3.3 RA3.2 RA1.2 RA3.4.2
FAULT INDICATOR DISPLAY	Fault Indicator Display can be installed as an alternative to refrigerant charge testing. Field verification is required.						

★ Ducts

- ✦ Ducts in conditioned space
 - And then I promise to test them for low leakage
- ✦ Verified duct design
- ✦ Buried ducts in attic
 - But now I promise to burry them even deeper
- ✦ Low leakage AH from factory, verified in field that it is installed with low leakage ducts



Verified Ducts



Verified Ducts

- ✦ Section 150.0(m)
 - ✦ New Construction
 - ✦ Altered system with new ducting, new air handler *and* new AC



Duct Option



Duct Design Layout Verification



12' or Less of Duct Located Outside Of Conditioned Space



Ducts Located Entirely In Conditioned Space

Performance option if not required prescriptively
Additional credit if duct leakage verified



Buried Ducts on The Ceiling R-Value









Deeply Buried Ducts R-Value



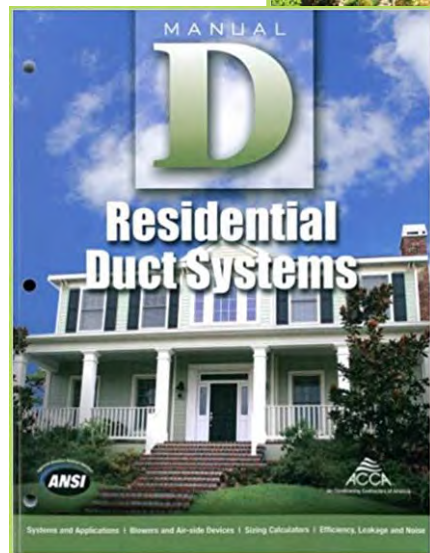
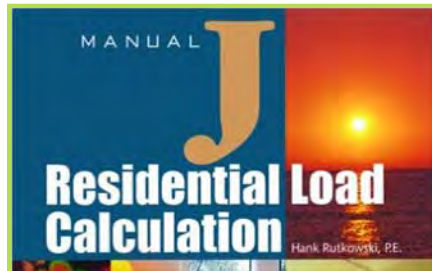
Verified Ducts



Duct Option	Description	Procedure
Duct Design Layout 	Verification, per the drawings provided designed per ACCA Manual D (or equal), of: <ul style="list-style-type: none"> • HVAC equipment location; • Supply and return grilles/register size and location; • Insulation R-value; • Duct location. 	RA3.1.4.1.1/2/3/4 and RA3.1.4.1.4 <i>Visual inspections in field and of design drawings</i>
12' or Less of Duct Located Outside Of Conditioned Space 	Confirm space conditioning duct systems with air handlers located outside the conditioned space have 12 linear feet or less of duct located outside the conditioned space including air handler and plenum	RA3.1.4.1.2 <i>Visual inspections</i>
Ducts Located Entirely In Conditioned Space  	<ul style="list-style-type: none"> • Confirm space conditioning duct systems are located entirely in conditioned space • If duct leakage testing required per CF1R-PRF, RA3.1.4.3 duct testing is required 	RA3.1.4.1.3 <i>Visual inspections</i> RA3.1.4.3 <i>Duct testing</i>
Buried Ducts on The Ceiling R-Value 	Prerequisite: Duct Design Layout <ul style="list-style-type: none"> • Buried under insulation R-value 4.2 or greater; • Within 3-1/2" from ceiling drywall; • Sign near attic access "Caution: Buried Ducts. Markers indicate location of buried ducts" • Visible vertical markers every 8' of entire duct length 	RA3.1.4.1.1 and RA3.1.4.1.5 <i>Visual inspections</i>
Deeply Buried Ducts R-Value 	The required depth of the ceiling insulation is maintained even where the ducts are buried. In other words, the duct is installed in a dropped soffit that is below the normal ceiling level.	RA3.1.4.1.6 <i>Visual inspections</i>



Duct Design



Design Guidance

- ❑ Use an approved design methodology – ACCA Manual J/S/D is the most common.
- ❑ Account for **all** static pressure losses:
 - ❑ Length of duct
 - ❑ Fittings (start collars, t-wyes, elbows, register boots)
 - ❑ Coil (use manufacturer's specs for pressure drop at design cfm)
 - ❑ Filter (Higher MERV requires larger surface area)
- ❑ Distribute air proportional to rooms' loads (air balance).
- ❑ Provide adequate ducting for ALL of the air (size to total cfm).
- ❑ ***Pay special attention to return air duct and grille. Bigger is always better.***



Performance HERS Measures: HVAC



Decoding * 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES	
		New	Altered					
AIR CONDITIONING MEASURES								
ENERGY EFFICIENCY RATIO (EER)	Compliance credit for increased EER by installation of specific air conditioner or heat pump models. Does not apply to equipment rated only with an EER.	New AC System	Altered AC system when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.4.5.4	RA3.4.3	
SEASONAL ENERGY EFFICIENCY RATIO (SEER)	Compliance credit for increased SEER by installation of specific air conditioner or heat pump models.						Res ACM 2.4.5.5	RA3.4.4
EVAPORATIVELY COOLED CONDENSERS	Compliance credit for installation of evaporatively cooled condensers. Duct leakage and refrigerant charge is required.						Res ACM 2.4.5.6 2.4.5.7	RA3.1.4.3; 3.2 RA3.4.3/4.1
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.	New Homes	Addition over 1,000 sq. ft.	CF2R/CF3R-MCH-27-H §150.0(o)			RA3.7.4.1 RA3.7.4.2	
BUILDING ENVELOPE MEASURES								
BUILDING ENVELOPE AIR LEAKAGE	Compliance credit can be taken for reduced building envelope air leakage.	New Homes	N/A			Res ACM 2.2.5.1	RA3.8	
HIGH QUALITY INSULATION INSTALLATION (QH)	Compliance credit can be taken for quality installation of insulation.		Addition only if present in CF1R-PRF			Res ACM 2.2.6	RA3.5	
SPRAY POLYURETHANE FOAM (SPF) INSULATION	Verify the installation of SPF insulation whenever R-values other than the default R-value per inch are used for compliance credit.		Altered Envelope Features if present in CF1R-PRF			Res ACM 2.3.3.2	RA3.5.6	
SINGLE FAMILY DOMESTIC HOT WATER MEASURES								
PIPE INSULATION CREDIT	Inspection to verify that all hot water piping in non-recirculating systems is insulated and that corners and tees are fully insulated. No piping should be visible due to insulation voids with the exception of the last segment of piping that penetrate walls and delivers hot water to the sink, appliance, etc.	New Homes	New HW Distribution System when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.9	RA3.6.3	
PARALLEL PIPING	Inspection that requires that the measured length of piping between the water heater and single central manifold does not exceed five feet.					Res ACM 2.9	RA3.6.4	

HVAC

Measure

Description

High SEER / High EER

Installation of SEER or EER greater than minimum efficiency requirements.

Evaporatively cooled condensers

Installation of evaporatively cooled condensers. Duct leakage; refrigerant charge; and EER verification is also required.



Performance HERS Measures



Decoding 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
AIR CONDITIONING MEASURES (CF1R-PRF-01-E)							
ENERGY EFFICIENCY RATIO (EER)	Compliance credit for increased EER by installation of specific air conditioner or heat pump models. Does not apply to equipment rated only with an EER.	New AC System	Altered AC system when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.4.5.4	RA3.4.3 RA3.4.4.1
SEASONAL ENERGY EFFICIENCY RATIO (SEER)	Compliance credit for increased SEER by installation of specific air conditioner or heat pump models.			Res ACM 2.4.5.5	RA3.4.3 RA3.4.4.1		
EVAPORATIVELY COOLED CONDENSERS	Compliance credit for installation of evaporatively cooled condensers. Duct leakage and refrigerant charge is required.			Res ACM 2.4.5.6 2.4.5.7	RA3.1.4.3; 3.2 RA3.4.3/4.1		
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.	New Homes	Addition over 1,000 sq. ft.	CF2R/CF3R-MCH-27-H \$150.00(o)			RA3.7.4.1 RA3.7.4.2
BUILDING ENVELOPE MEASURES							
BUILDING ENVELOPE AIR LEAKAGE	Compliance credit can be taken for reduced building envelope air leakage.	New Homes	N/A			Res ACM 2.2.5.1	RA3.8
HIGH QUALITY INSULATION INSTALLATION (QII)	Compliance credit can be taken for quality installation of insulation.		Addition only if present in CF1R-PRF			Res ACM 2.2.6	RA3.5
SPRAY POLYURETHANE FOAM (SPF) INSULATION	Verify the installation of SPF insulation whenever R-values other than the default R-value per inch are used for compliance credit.		Altered Envelope Features if present in CF1R-PRF			Res ACM 2.3.3.2	RA3.5.6
SINGLE FAMILY DOMESTIC HOT WATER MEASURES (CF1R-PRF-01-E)							
PIPE INSULATION CREDIT	Inspection to verify that all hot water piping in non-recirculating systems is insulated and that corners and tees are fully insulated. No piping should be visible due to insulation voids with the exception of the last segment of piping that penetrate walls and delivers hot water to the sink, appliance, etc.	New Homes	New HW Distribution System when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.9	RA3.6.3
PARALLEL PIPING	Inspection that requires that the measured length of piping between the water heater and single central manifold does not exceed five feet.			Res ACM 2.9	RA3.6.4		

Envelope: NEW

Measure	Description
Building Envelope Sealing	Measurement of the air tightness of a building envelope for determining the energy credit allowance for reduced building air leakage.
Quality Insulation Installation (QII)	Recognizes standard and improved envelope construction <ul style="list-style-type: none"> • Continuous Air Barrier • Installation on insulation per manufacturer's instructions • Insulated headers • Multiple inspections • MUST BE COORDINATED AT DESIGN
Spray Polyurethane Foam (SPF) Insulation	When credit taken for SPF R-values that exceed "default" <ul style="list-style-type: none"> • Open cell: R-value=3.6/inch • Closed cell: R-value=5.8/inch



Performance HERS Measures



Decoding 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
AIR CONDITIONING MEASURES (CF1R-PRF-01-E)							
ENERGY EFFICIENCY RATIO (EER)	Compliance credit for increased EER by installation of specific air conditioner or heat pump models. Does not apply to equipment rated only with an EER.	New AC System	Altered AC system when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.4.5.4	RA3.4.3 RA3.4.4.1
SEASONAL ENERGY EFFICIENCY RATIO (SEER)	Compliance credit for increased SEER by installation of specific air conditioner or heat pump models.					Res ACM 2.4.5.5	RA3.4.3 RA3.4.4.1
EVAPORATIVELY COOLED CONDENSERS	Compliance credit for installation of evaporatively cooled condensers. Duct leakage and refrigerant charge is required.					Res ACM 2.4.5.6 2.4.5.7	RA3.1.4.3; 3.2 RA3.4.3/4.1
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.	New Homes	Addition over 1,000 sq. ft.	CF2R/CF3R-MGH-27-4H \$150.0(0)			RA3.7.4.1 RA3.7.4.2
BUILDING ENVELOPE MEASURES							
BUILDING ENVELOPE AIR LEAKAGE	Compliance credit can be taken for reduced building envelope air leakage.	New Homes	N/A			Res ACM 2.2.5.1	RA3.8
HIGH QUALITY INSULATION (HQI)	Compliance credit can be taken for quality installation of insulation.		Addition only if present in CF1R-PRF			Res ACM 2.2.6	RA3.5
SPRAY POLYURETHANE FOAM (SPF) INSULATION	Verify the installation of SPF insulation whenever R-values other than the default R-value per inch are used for compliance credit.		Altered Envelope Features if present in CF1R-PRF			Res ACM 2.3.3.2	RA3.5.6
SINGLE FAMILY DOMESTIC HOT WATER MEASURES (CF1R-PRF-01-E)							
PIPE INSULATION CREDIT	Inspection to verify that all hot water piping in non-recirculating systems is insulated and that corners and tees are fully insulated. No piping should be visible due to insulation voids with the exception of the last segment of piping that penetrate walls and delivers hot water to the sink, appliance, etc.	New Homes	New HW Distribution System when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.9	RA3.6.3
PARALLEL PIPING	Inspection that requires that the measured length of piping between the water heater and single central manifold does not exceed five feet.					Res ACM 2.9	RA3.6.4

Plumbing

Measure

Description

Pipe Insulation and/or Verified Design

- Pipe Insulation
- Parallel piping
- Compact design
- Point of use

Pipe Insulation: All hot water piping in non-recirculating systems is insulated and that corners and tees are fully insulated with the exception of the last segment of piping that penetrate walls and delivers hot water to the sink, appliance, etc.

Parallel piping: Measured length of piping between the water heater and single central manifold does not exceed five feet

Compact design: longest pipe run from any use point to the water heater serving that use point does not exceed a maximum length per RA3.6.5 Table 3.6.5

Point of use: All hot water fixtures in the dwelling unit, with the exception of the clothes washer, must be located within a restricted length per RA3.6.5 Table 3.6.5

Recirculation Pump Control

- Manual
- Sensor

Manual: A manual switch is used for the DHW recirculation pump

Sensor: A sensor control is used for the DHW recirculation pump

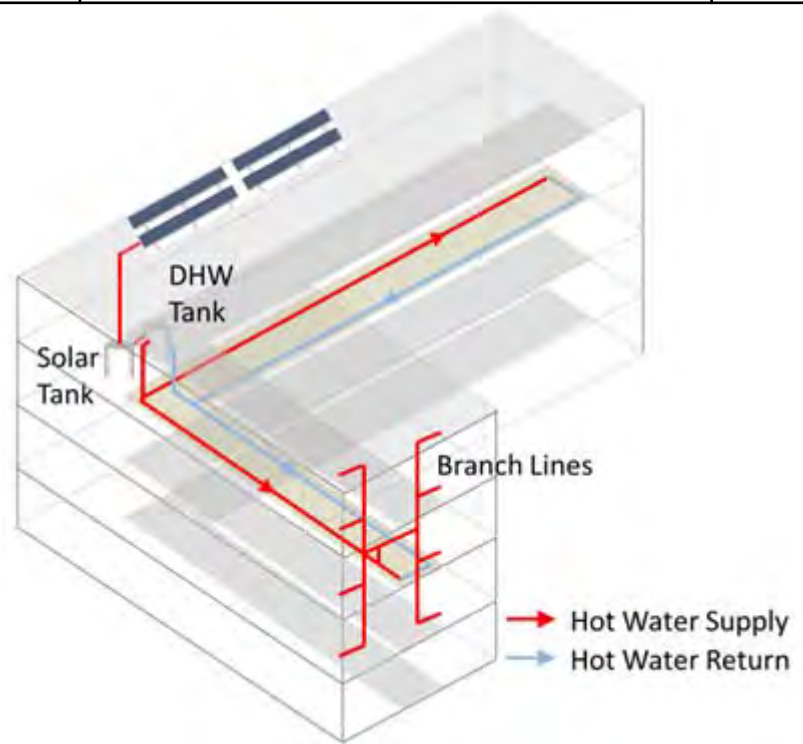
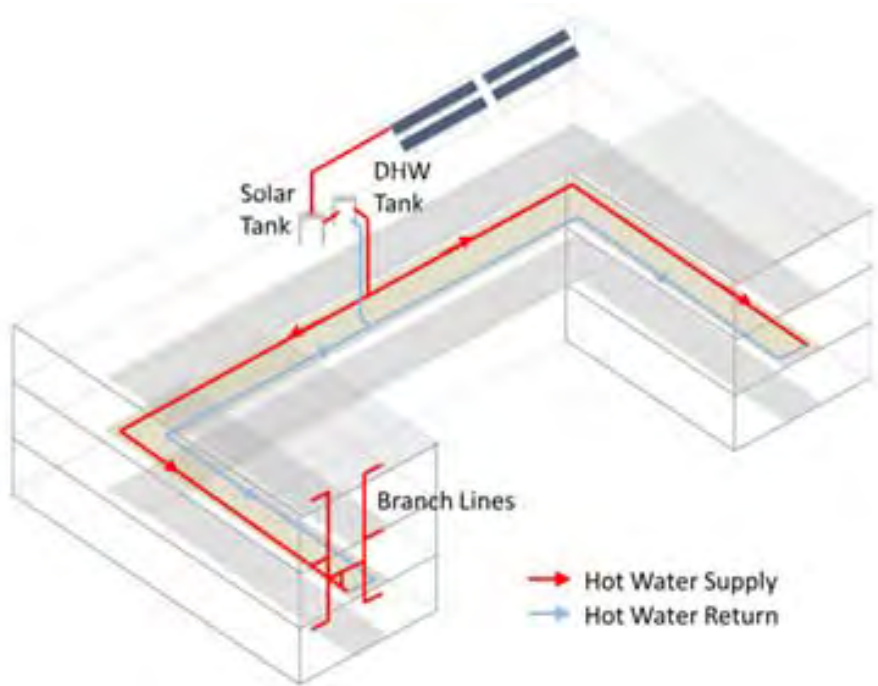


Performance HERS Measures



Plumbing

Measure	Description	RA #
Multi Family Recirculation Loop	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.	3.6 <i>Visual inspections</i>





Decoding Talk: HERS Measures (Pg 4)



Decoding * 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
SINGLE FAMILY DOMESTIC HOT WATER MEASURES CTR-PRF-01-E							
COMPACT HOT WATER DISTRIBUTION SYSTEM	Longest pipe run from the water heater to a HW fixture does not exceed a maximum length per RA3.6.5					Res ACM 2.9	RA3.6.5
POINT OF USE	A hot water fixture in a dwelling unit, except the clothes washer, must be located within a restricted length based on pipe diameter from a water heater	New Home	New HW Distribution System when used in a			Res ACM 2.9	RA3.6.6

Existing Building Features

✦ Credit for improving building features

✦ See RCM Appendix G

Altered Component	Standard Design <i>Without</i> Third Party Verification of Existing Conditions Shall be Based On	Standard Design <i>With</i> Third Party Verification of Existing Conditions Shall be Based On
Ceiling Insulation, Wall Insulation, and Raised-floor Insulation	The requirements of Sections 150.0(a), (c), and (d)	The existing insulation R-value
Fenestration	The U-factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.	If the proposed U-factor is ≤ 0.40 and SHGC value is ≤ 0.35 , the standard design shall be based on the existing U-factor and SHGC values as verified. Otherwise, the standard design shall be based on the U-factor of 0.40 and SHGC value of 0.35.
Window Film	The U-factor of 0.40 and SHGC value of 0.35.	The existing fenestration in the alteration shall be based on Default Fenestration Values Table(s) 110.6
Space-Heating and Space-Cooling Equipment	The requirements of TABLE 150.1-A.	The existing efficiency levels.
Air Distribution System – Duct Sealing	The requirements of Section 150.2(b)1D.	
Air Distribution System – Duct Insulation	The proposed efficiency levels.	The existing efficiency levels.
Water Heating Systems	The requirements of Section 150.1(b)1 the solar water heating requirements.	The existing efficiency energy factor.
Roofing Products	The requirements of Section 150.2(b)1H.	
All Other Measures	The proposed efficiency levels.	The existing efficiency levels.



Challenge C

Challenge C

Nonresidential
Prescriptive/Performance
HERS Measures



Forms: Duct Testing

ONLY the NRCV-MCH forms needs to be registered with HERS provider

Document Category

PRF = Performance approach
CXR = Commissioning
ELC = Electrical
ENV = Envelope
LTI = Indoor Lighting
LTO = Outdoor Lighting

LTS = Sign Lighting

MCH = Mechanical

PLB = Plumbing (DHW)

PRC = Covered Process

SPV = Photovoltaic

SRA = Solar Ready

STH = Solar Thermal

Nonresidential

NR CC - PRF - 01 - E

Document Type

Certificates of...

CC = Compliance

CI = Installation

CA = Acceptance

CV = Verification (HERS)

Primary user

E = Enforcement agency

H = HERS Rater

F = Field Technician
(Contractor)

A = Acceptance Test Tech



Mandatory Measures



*Cannot be traded via the Performance Approach.
Not typically documented within Certificate of
Compliance (CF1R)*

Two Ways to Comply with the Standards



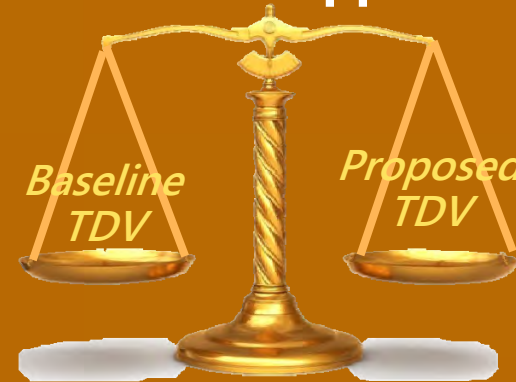
Prescriptive Approach



*Each building feature to show
compliance independently*



Performance Approach



*Proposed TDV equal or better
than baseline TDV*

Compliance Documentation



Decoding Talk: HERS Measures



Decoding 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
SINGLE FAMILY DOMESTIC HOT WATER MEASURES							
COMPACT HOT WATER DISTRIBUTION SYSTEM	Longest pipe run from the water heater to a HW fixture does not exceed a maximum length per RA3.6.5	New Home	New HW Distribution System when used in a performance calculation (CFIR-PHF-01-E)			Res ACM 2.9	RA3.6.5
POINT OF USE	A hot water fixture in a dwelling unit, except the clothes washer, must be located within a restricted length based on pipe diameter from a water heater.					Res ACM 2.9	RA3.6.6
DEMAND RECIRCULATION: MANUAL CONTROL	Inspection to verify that all recirculating hot water piping is insulated and that corners and tees are fully insulated.					Res ACM 2.9	RA3.6.7
DEMAND RECIRCULATION: SENSOR CONTROL	Inspection to verify that all recirculating hot water piping is insulated and that corners and tees are fully insulated.					Res ACM 2.9	RA3.6.8
LOWRISE AND HIGHRISE MULTIFAMILY DOMESTIC HOT WATER HEATING MEASURES							
MULTIPLE RECIRCULATION LOOP DESIGN FOR DHW SYSTEMS	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.	New Lowrise and Highrise Multifamily Building	New HW Distribution System			Lowrise CFIR-PHF-01-E Res ACM 2.9.2 Highrise NRCCE-PHF-01-E NonRes ACM 5.9.1.4	RA3.6.9 RA4.4
PRE-EXISTING HERS VERIFIED MEASURES							
HERS VERIFIED PRE-EXISTING CONDITIONS	Performance credit for improving an existing building feature beyond "default" per Table 150.2-C, verified by visual inspection.	N/A	Altered Existing Building Feature			Res ACM 2.10.3	Res Manual App. G

Nonresidential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
SINGLE FAMILY DOMESTIC HOT WATER 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.	New constant volume single zone system serving <5,000 ft ³ ; >25% of ducting outside conditioned space.	Altered system or ducting associated single zone system serving <5,000 ft ³ ; >25% of ducting outside conditioned space.			NRCEV-MCH-04-II 9140.4(f)	NonRes ACM 5.7.3.6 New: 6% Altered: 15% or smoke test

◆ Ducts

◆ Duct Testing



Duct Testing



Duct Testing



ergy, LLC

✦ Section 140.4(l) / 141.0(b)E

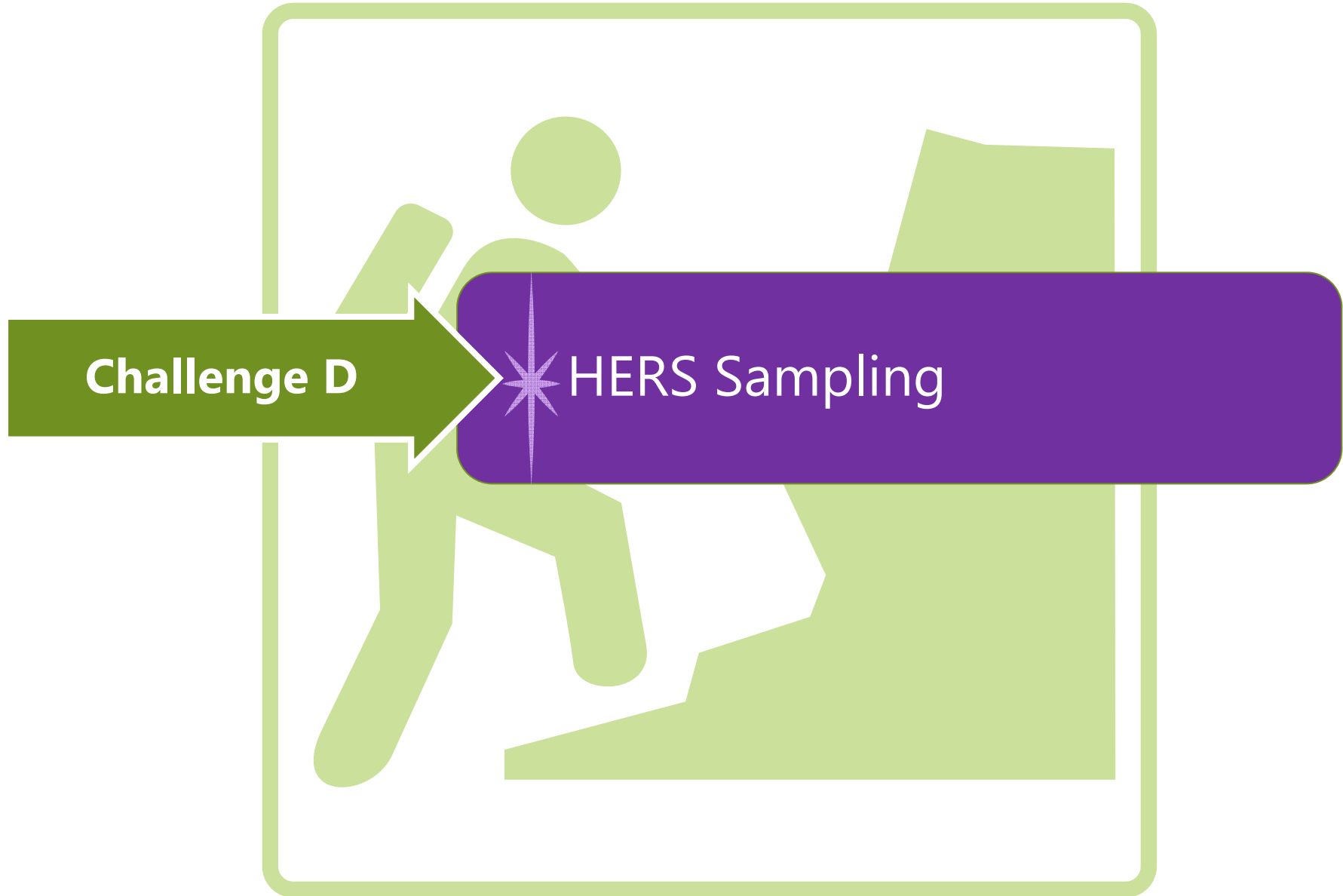
✦ New systems or altered systems (new HVAC components or ANY length of duct)

- *Constant volume, single zone system AND*
- *Serves <5,000 ft² AND*
- *More than 25% of the ducts outside the conditioned space.*

Description	Procedure
Verify that duct leakage is less than or equal to the compliance criteria: <ul style="list-style-type: none">• New Duct Systems: 6%• Altered Duct Systems: 15%<ul style="list-style-type: none">• or "I did the best I can" as verified by a smoke test with HERS rater	NA2.1.4

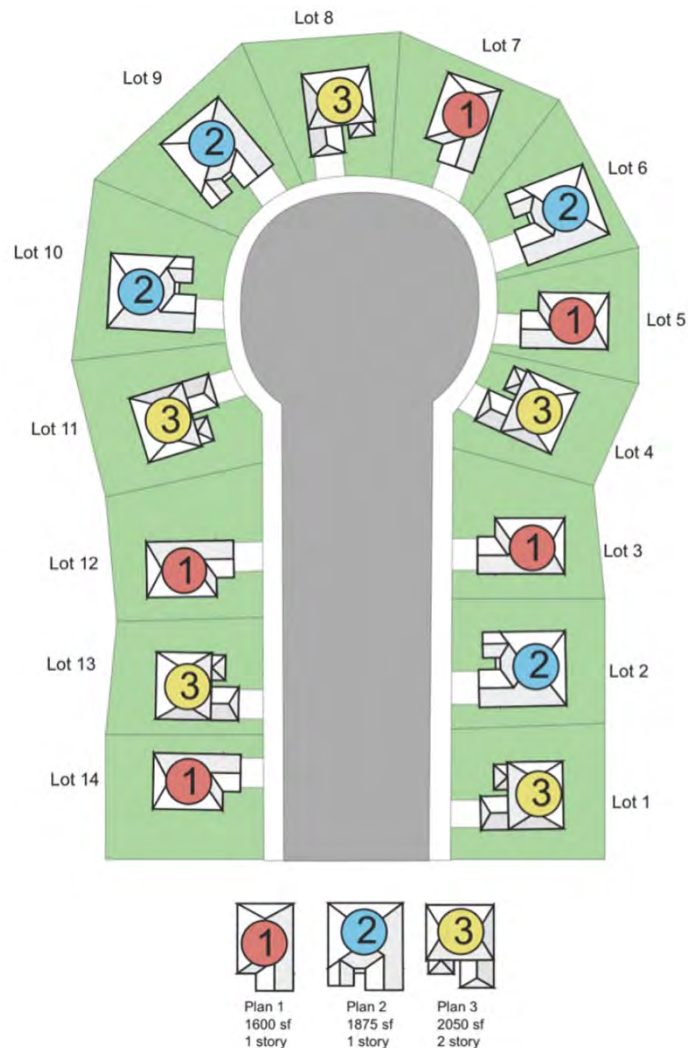


Challenge D





Sampling



General

- ✦ Sampling is a means by which multiple homes can be passed as a "group" by having the rater just test one home.
- ✦ Every house **MUST** be tested by the installing contractor **PLUS** one from each group tested by rater.
- ✦ This **may or may not** be more cost effective than having the rater test every house.

Diagram courtesy of CalCERTS, inc.



HERS Sampling

New Construction

✦ Sampling for new homes only applies to subdivisions and multi-family projects.



- ✦ Must Test first of each "Model" before sampling of that model can begin.
- ✦ Closed Group: no more than 7 homes, all finished and tested by subcontractor prior to sampling.
- ✦ Open Group: no more than 5 homes in group. All homes do not have to be completed prior to selecting sampled home. Homes can be added to group after one is sampled. (obvious loophole)



HERS Sampling

Alterations

- ★ HVAC Alterations Projects by the same HVAC installer can be sampled even if in different jurisdictions.



- ★ Closed Group Sampling Only
- ★ Systems (not houses) are sampled as a single unit.
- ★ One house with 7 systems to be tested could be its own sample group.
- ★ All systems in a group must need the same set of HERS tests.



Project Status Report

What Project is "Sampled"?

CF3R INFORMATION - Certificates of Verification (Documents the verification of HERS Measures)					✓
System	Form	Registered Date	Registration Number		
	CF3R-MCH-20-H (Duct Leakage)	09/14/2016 08:28	Registration # HERS rater name and co.	✓	✓
	CF3R-MCH-23-H (Airflow)	09/14/2016 08:28	Registration # HERS rater name and co.	✓	✓
	CF3R-MCH-22-H (Fan Efficacy)	09/14/2016 08:28	Registration # HERS rater name and co.	✓	✓
	CF3R-MCH-26-H (Rated Equipment)	09/14/2016 08:28	Registration # HERS rater name and co.	✓	✓
	CF3R-MCH-27-H (IAQ and MV)	09/14/2016 08:28	Registration # HERS rater name and co.	✓	✓

SAMPLE GROUP	Sample Group #		
Milpitas	street address	95035	[View Results]
Milpitas	street address	95035	[View Results]
Milpitas	street address	95035	
Milpitas	street address	95035	[View Results]



HERS Sampling

Re-Sampling

✦ When the sampled unit *"fails"*, a second is randomly selected and tested.



- ✦ If the second (resampled) unit passes, the first fail is deemed an *"oops"*, corrected, then all pass.
 - ✦ This should raise some flags: Why did first unit pass when the installer tested it but not when the rater tested it?
- ✦ If the second (resampled) unit fails, all units in the group must be tested.



HERS Sampling

Caution!

✦ Sampling may seem like a reasonable shortcut, but it can cause unforeseen complications. Fails are a much “bigger deal”.



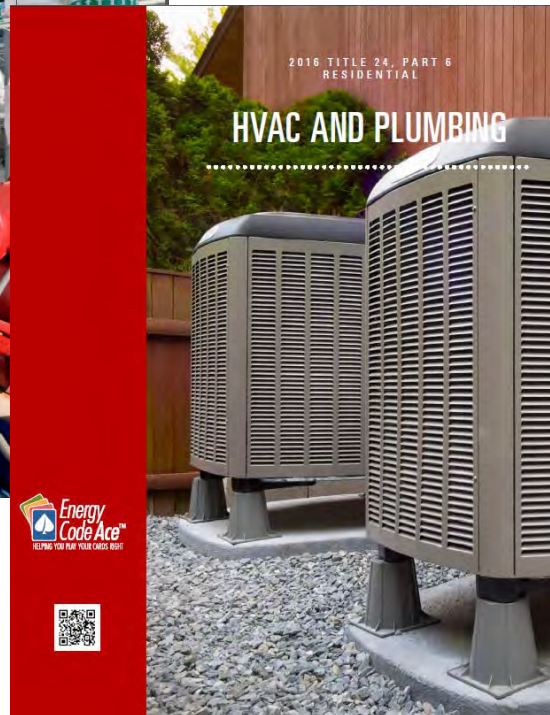
- ✦ Sampling for QII is allowed but can be very complicated due to the multiple visits required for QII inspections.
- ✦ Sampling for alterations is allowed across jurisdictional borders, but jurisdictions can prevent that for projects within their jurisdictions.



Next Steps



HELPING YOU PLAY YOUR CARDS RIGHT



Short manuals including compliance requirements and recommendations for implementing Title 24, Part 6 in new construction, addition and renovation projects.





CalCERTS Resources



★ CalCERTS raters and anyone affiliated with a project in the CalCERTS registry (builder, installer, building department, home owner, etc.) are welcome to contact CalCERTS with questions.

- field@calcerts.com - code and verification requirements
- tech@calcerts.com - issues pertaining to registry operations

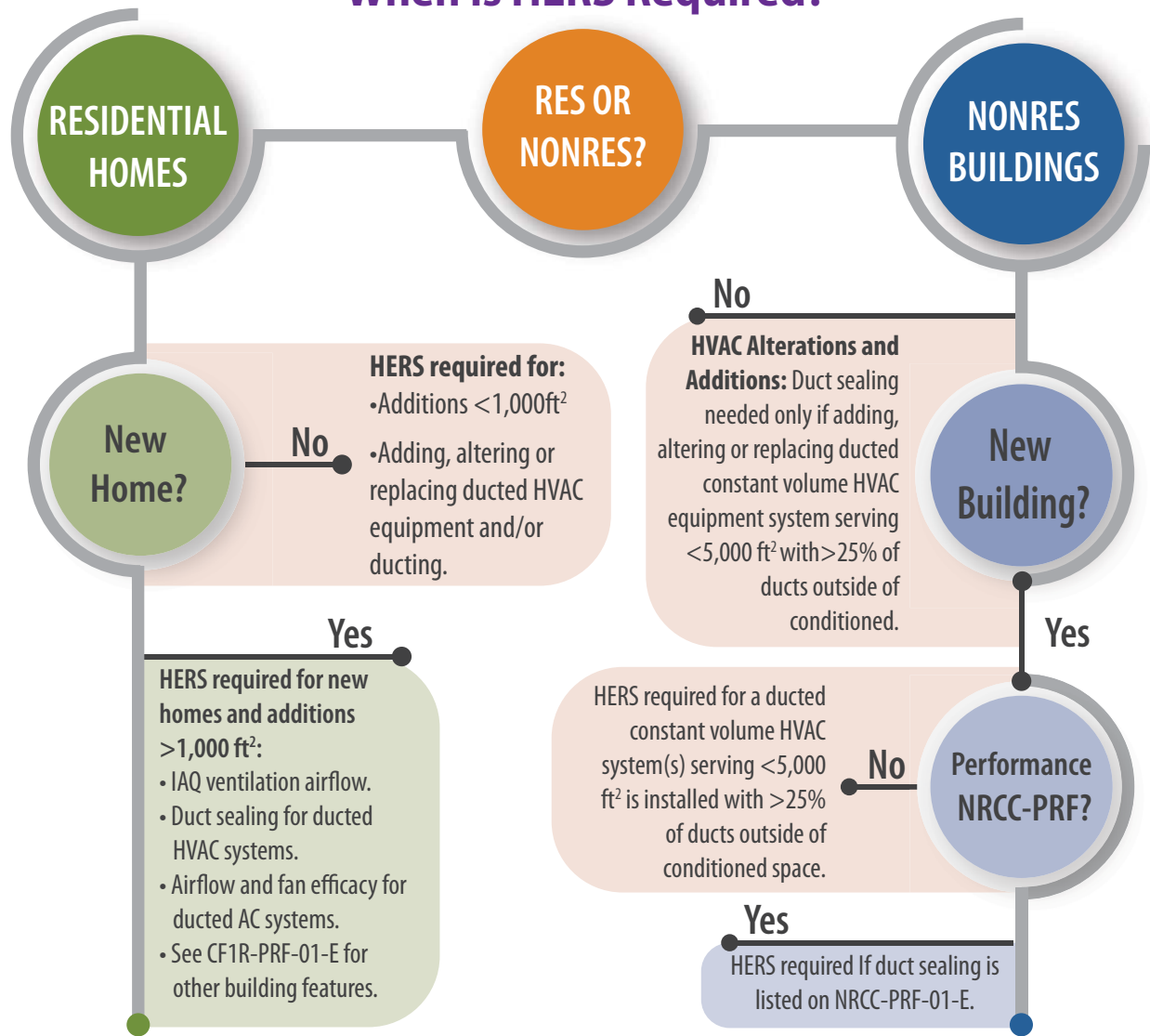


For information about becoming a HERS rater just visit www.calcerts.com

CalCERTS is rolling out a new 1 hour on-site training for building departments on how to use the registry to avoid the need for printed compliance forms.



When Is HERS Required?



When is HERS NOT required for Residential?

Alterations & Additions ≤ 1,000 ft²:

- a) When there are no changes and additions to a ducted HVAC system. Examples include:
 - i) Adding a ductless wall furnace
 - ii) Extending < 40 linear ft. of ducting to an existing HVAC system
 - iii) Changing or adding a water heater
 - iv) Changing or adding lighting
 - v) Changing or replacing envelope features that are NOT to be HERS pre-verified in a performance calculation such as window replacement and reroof(s)

Note: HERS will always be required for New Construction/Additions > 1,000 ft²






For more information, check out..
www.energycodeace.com

Trigger Sheet(s): Residential HVAC Alterations 2016 / Nonresidential New HVAC: Simple and Complex Systems 2016.

Factsheet: Just the Basics: HERS for Residential and Nonresidential Projects 2016.

Application Guide(s): 2016 Residential HVAC and Plumbing / 2016 Nonresidential HVAC and Plumbing.

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES		
		New	Altered						
AIR CONDITIONING MEASURES						CF1R-PRF-01-E			
ENERGY EFFICIENCY RATIO (EER)	<i>Compliance credit for increased EER by installation of specific air conditioner or heat pump models. Does not apply to equipment rated only with an EER.</i>	New AC System	Altered AC system when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.4.5.4	RA3.4.3 RA3.4.4.1		
SEASONAL ENERGY EFFICIENCY RATIO (SEER)	<i>Compliance credit for increased SEER by installation of specific air conditioner or heat pump models.</i>					Res ACM 2.4.5.5	RA3.4.3 RA3.4.4.1		
EVAPORATIVELY COOLED CONDENSERS	<i>Compliance credit for installation of evaporatively cooled condensers. Duct leakage and refrigerant charge is required.</i>					Res ACM 2.4.5.6 2.4.5.7	RA3.1.4.3, 3.2 RA3.4.3/4.1		
MECHANICAL VENTILATION MEASURES									
CONTINUOUS OR INTERMITTENT IAQ	<i>Measurement of whole-building mechanical ventilation. If central fan integrated system used, verification of installation and intermittent controls.</i>	New Homes	Addition over 1,000 sq. ft.	CF2R/CF3R-MCH-27-H §150.0(o)			RA3.7.4.1 RA3.7.4.2		
BUILDING ENVELOPE MEASURES									
BUILDING ENVELOPE AIR LEAKAGE	<i>Compliance credit can be taken for reduced building envelope air leakage.</i>	New Homes	N/A			Res ACM 2.2.5.1	RA3.8		
HIGH QUALITY INSULATION INSTALLATION (QH)	<i>Compliance credit can be taken for quality installation of insulation.</i>		Addition only if present in CF1R-PRF			Res ACM 2.2.6	RA3.5		
SPRAY POLYURETHANE FOAM (SPF) INSULATION	<i>Verify the installation of SPF insulation whenever R-values other than the default R-value per inch are used for compliance credit.</i>		Altered Envelope Features if present in CF1R-PRF			Res ACM 2.3.3.2	RA3.5.6		
						MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
SINGLE FAMILY DOMESTIC HOT WATER MEASURES						CF1R-PRF-01-E			
PIPE INSULATION CREDIT	<i>Inspection to verify that all hot water piping in non-recirculating systems is insulated and that corners and tees are fully insulated. No piping should be visible due to insulation voids with the exception of the last segment of piping that penetrate walls and delivers hot water to the sink, appliance, etc.</i>	New Homes	New HW Distribution System when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.9	RA3.6.3		
PARALLEL PIPING	<i>Inspection that requires that the measured length of piping between the water heater and single central manifold does not exceed five feet.</i>					Res ACM 2.9	RA3.6.4		

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
SINGLE FAMILY DOMESTIC HOT WATER MEASURES						CF1R-PRF-01-E	
COMPACT HOT WATER DISTRIBUTION SYSTEM	<i>Longest pipe run from the water heater to a HW fixture does not exceed a maximum length per RA3.6.5</i>	New Home	New HW Distribution System when used in a performance calculation (CF1R-PRF-01-E)			Res ACM 2.9	RA3.6.5
POINT OF USE	<i>A hot water fixtures in a dwelling unit, except the clothes washer, must be located within a restricted length based on pipe diameter from a water heater.</i>					Res ACM 2.9	RA3.6.6
DEMAND RECIRCULATION: MANUAL CONTROL	<i>Inspection to verify that all recirculating hot water piping is insulated and that corners and tees are fully insulated.</i>					Res ACM 2.9	RA3.6.7
DEMAND RECIRCULATION: SENSOR CONTROL	<i>Inspection to verify that all recirculating hot water piping is insulated and that corners and tees are fully insulated.</i>					Res ACM 2.9	RA3.6.8
LOWRISE AND HIGHRISE MULTIFAMILY DOMESTIC HOT WATER HEATING MEASURES							
MULTIPLE RECIRCULATION LOOP DESIGN FOR DHW SYSTEMS	<i>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.</i>	New Lowrise and Highrise Multifamily Building	New HW Distribution System			Lowrise CF1R-PRF-01-E Res ACM 2.9.2 Highrise NRCC-PRF-01-E NonRes ACM 5.9.1.4	RA3.6.9 RA4.4
PRE-EXISTING HERS VERIFIED MEASURES							
HERS VERIFIED PRE-EXISTING CONDITIONS	<i>Performance credit for improving an existing building feature beyond "default" per Table 150.2-C, verified by visual inspection.</i>	N/A	Altered Existing Building Feature			Res ACM 2.10.3	Res Manual App. G

Nonresidential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPENDICES
		New	Altered				
SINGLE FAMILY DOMESTIC HOT WATER MEASURES							
DUCT SEALING	<i>Field verification and diagnostic testing is required to verify that approved duct system materials are utilized, and that duct leakage meets the specified criteria.</i>	New constant volume single zone system serving <5,000 ft ² , >25% of ducting outside conditioned space.	Altered system or ducting associated with constant volume single zone system serving <5,000 ft ² , >25% of ducting outside conditioned space.		NRCV-MCH-04-H §140.4(l)	NonRes ACM 5.7.3.6	NA1, NA2.1 New: 6% Altered: 15% or smoke test



What is HERS?

HERS stands for Home Energy Rating System, and is a program developed to address poor construction quality and equipment installation. In the 2016 Building Energy Efficiency Standards (Energy Standards) technologies and systems that trigger HERS verification are considered "HERS measures." These cover HVAC systems, ductwork, ventilation, plumbing and insulation for residential projects, and ductwork for nonresidential projects. In order to verify these HERS measures, certified HERS Raters perform onsite inspections and tests, to ensure proper installation and code compliance.

Type of projects requiring HERS verification:

- Residential, multifamily, and nonresidential (newly constructed buildings, and additions and alterations)
- [New Solar Homes Partnership Program](#) (newly constructed residential buildings)
- Those pursuing a California Whole-House Home Energy Rating

The [Forms Ace tool](#) is useful in determining if any HERS verification measures and forms apply to a specific project or scenario.

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 Standards. The HERS verification process ensures that the proposed HERS measures are installed and meet code compliance.

Who Does What?

HERS Raters

have been trained and certified by a HERS Provider to verify compliance of HERS measures with California's Energy Standards. 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 third-party 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. Each HERS Provider reports registry data to the Energy Commission on an annual basis so the State can benchmark energy savings measures.

HERS Rater vs. Building Inspector

HERS Raters perform inspections and field verification for HERS measures. These are measures that need more in depth knowledge and usually require special testing equipment to verify the systems installed are working as designed. HERS Raters have been specifically trained and certified to perform this work. HERS Raters are similar to special inspectors and verify compliance on behalf of the building owner.

Building Inspectors

perform inspections for all Building Codes (Structural, Electrical, Plumbing, etc.) during set times throughout construction.

Find a HERS Rater

Contact a HERS Provider listed on the [California Energy Commission's HERS Providers](#) page to find a local HERS Rater. Many HERS Providers have regional search capabilities on their websites.

Compliance Documents

There are several documents that the Building Department will need 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, and CF1R for residential): Completed by designer, energy consultant, installing contractor or sometimes the owner
- Certificate of Installation (NRCI for nonresidential, and CF2R for residential): Completed by the installing contractor
- Certificate of HERS Verification (NRCV for nonresidential, and CF3R for residential): Completed by the HERS Rater



The [residential compliance documents](#) and the [nonresidential compliance documents](#) are located on the California Energy Commission's website.

As a building owner or homeowner, the compliance documents are yours to keep. These documents are designed to ensure that the installed energy-efficient equipment is in compliance with the Energy Standards and should be passed along with the building's ownership.

How do I register compliance documents?

Registering compliance documentation is a process designed to ensure that equipment is installed in accordance with the Energy Standards requirements listed on the Certificate of Compliance. The Building Department will require a registered CF1R before issuing a permit if HERS measures are required (with limited exceptions). For nonresidential projects, the NRCC is not required to be registered, only the HERS forms (NRCV) are required to be registered.

- **New Construction and Additions:** 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" or 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.
- **Alterations:** The compliance documentation for alterations is generally initiated by the installing contractor and does not require the owner to sign-off.

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.



What do I do after my compliance documents are approved in the HERS Registry?

Once the compliance documents have been approved and signed-off by all responsible parties, they are 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 - 2016 Residential Compliance	Report Version: CF1R-04141016-574	Report Generated at: 4/29/2017:9:35:55 PM

When do I need to hire a HERS Rater?

A homeowner or installing contractor will need to hire a HERS Rater when the CF1R or NRCC requires HERS measures. 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.

For new construction and additions, 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. This is also the case with alterations, but typically the installing contractor will assign the Rater to the project. The cost of HERS Raters varies depending on the HERS measure.

Residential Requirements

Mandatory

The following examples are features that will likely trigger Mandatory HERS verification requirements.

New homes or additions greater than 1,000 ft²

- Triggers the indoor air quality (IAQ) ventilation measure, which requires the installation of a mechanical ventilation system that complies with the airflow rate required by ASHRAE Standard 62.2. A HERS Rater would use airflow measurement tools to verify compliance.

New or altered central HVAC equipment or altered/extended ductwork more than 40ft

- Triggers duct leakage testing to verify minimal duct leakage (<5% for new systems and <15% for altered). This measure ensures your cooling and heating systems are efficiently transferring air to conditioned spaces. This is the most common HERS measure.

New HVAC equipment or replacing existing HVAC systems with all new equipment and all new ductwork

- Triggers air flow and fan watt draw measures, to verify an improved airflow rate of 350 cfm/ton in forced air systems and a reduced fan power draw to 0.58 Watt/cfm. These tests verify motor efficacy and that the duct system has low air flow resistance.

Prescriptive

If your project is using the Prescriptive method and involves one of the following features, you will likely trigger HERS verifications.

New HVAC equipment with AC or altered AC systems in Climate Zones 2, 8-15 (find Climate Zone by zip code or area [here](#))

- Triggers refrigerant charge testing to verify correct refrigerant charge. This will assure proper refrigerant charge of your AC unit.

New ducts in conditioned space

- Triggers visual inspection of duct location and duct testing to verify low leakage to the outside. Duct insulation is required.

Using a central forced air unit (FAU) for mechanical ventilation (central fan integrated ventilation)

- Triggers fan watt draw and airflow testing similar to the mandatory measure process.

Using a zonally controlled forced air unit (FAU), bypass cannot be used

- Triggers visual inspection to confirm that the bypass ducts are not used. Bypass ducts can send heated or cooled air back into the space conditioning equipment, which can cause problems and reduce efficiency.

Whole-House Home Energy Rating

A whole-house home energy rating is a way for homeowners to compare the energy usage of their home to other similar homes and identify additional ways to reduce energy. This rating is performed through a series of energy audits or evaluations. The initial audit assesses the building and identifies potential energy efficiency improvements. It identifies a path for the owner to improve the efficiency of their property.

Once the improvements have been completed, a Whole-House Home Energy Rating is performed. This rating lets homeowners know how their home compares to others and provides an official certificate that shows their energy score on a specific statewide scale.

It is of particular interest if you are considering the sale of your home since the rating will convey the home's relative energy efficiency. A trained and certified HERS Rater can perform the audit and provide the report for a Whole-House Home Energy Rating. For more information, see [approved HERS Providers' websites](#) or the CEC's [Home Energy Rating System Booklet](#).

Performance

If you use the Performance approach to demonstrate project compliance, you will likely need an energy consultant or Certified Energy Analyst (CEA) to analyze the project and complete the compliance documentation. See the California Association of Building Energy Consultants (CABEC) [website](#) for more information on finding a CEA. Common Performance measures that require HERS verification include:

- Quality Insulation Installation (QII)
- Building envelope sealing
- Refrigerant charge or installation of a fault indicator display (FID)
- Ducts in conditioned space
- High SEER/EER
- Verified hot water pipe insulation and parallel piping

For more information on residential HERS measures, see the Energy Code Ace [Quick Reference Sheet for Residential and Nonresidential HERS Measures](#).

Nonresidential Requirements

Table 1 outlines the 2016 Nonresidential HERS Requirements.




HERS Measures	Mandatory 	Prescriptive 	Performance ^A 	Reference Appendices
MECHANICAL				
Duct sealing (maximum leakage)		§140.4(l) §141.0(b)2D §141.0(b)2E		NA1, NA2, RA3.1
Low leakage air handlers			§110.2(f)	RA3.1
PLUMBING				
Multifamily/Hotel & Motel recirculation systems (piping and controls)		§150.1(c)8	X	RA4.4
Multifamily/Hotel & Motel pipe insulation		§150.1(c)8	X	RA4.4
A An "X" indicates "may be taken as a Performance requirement and must be field-verified if taken."				

Table 1: Nonresidential HERS Requirements

HVAC Definitions

Entirely New System: All system heating/cooling equipment is replaced and ≥ 75% of the duct material is new.

Altered or Replaced Ducts: When ≥ 75% of the duct system is new or replaced. Existing duct system components (up to 25%) can be reused if they are accessible and can be sealed. Replacement or extension of ductwork over 40 feet is also within this category.

Altered Systems: A system altered by installing or replacing a cooling coil, condenser unit, compressor, refrigerant piping, refrigerant metering device, air handler, or heat exchanger. Replacing other components is considered a repair and not subject to code compliance.

For More Information

Find A...

- HERS Rater:
energy.ca.gov/HERS/providers.html
- Certified Energy Analyst:
cabec.org/find/

California Energy Commission Information & Services

- Energy Standards Hotline: 1-800-772-3300 (Free) or Title24@energy.ca.gov
- Online Resource Center:
energy.ca.gov/title24/orc/
 - The Energy Commission's main web portal for Energy Standards, including information, documents, and historical information
- Home Energy Rating System (HERS) Program Sub-site:
energy.ca.gov/HERS/
- What is Your Home Energy Rating booklet
energy.ca.gov/HERS/booklet.html
- California Building Climate Zone Map:
energy.ca.gov/maps/renewable/building_climate_zones.html

Additional Resources

- California Association of Building Energy Consultants (CABEC):
cabec.org
 - For information on where to find a Certified Energy Analyst (CEA)
- 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. Please register with the site and select an industry role for your profile in order to receive messages about all our free offerings!

Of special interest:

- HERS Measures Quick Reference Sheet:
EnergyCodeAce.com/content/resources-fact-sheets/
- 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!



This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy Commission. © 2016 Pacific Gas and Electric Company, San Diego Gas and Electric, Southern California Gas Company and Southern California Edison. All rights reserved, except that this document may be used, copied, and distributed without modification. Neither PG&E, Sempra, nor SCE — nor any of their employees makes any warranty, express of implied; or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any data, information, method, product, policy or process disclosed in this document; or represents that its use will not infringe any privately-owned rights including, but not limited to patents, trademarks or copyrights.



Project Address: _____

Contacts: _____

OVERALL REQUIREMENT					YES	NO	
All compliance documents completed, signed and registered, if required (HERS verification triggers registration.)					<input type="checkbox"/>	<input type="checkbox"/>	
CF1R (Certificate of Compliance - most current, if revised from plan review)					<input type="checkbox"/>	<input type="checkbox"/>	
CF2R (Certificates of Installation)					<input type="checkbox"/>	<input type="checkbox"/>	
CF3R (Certificates of Verification- HERS)					<input type="checkbox"/>	<input type="checkbox"/>	
Define Fuel Type <input type="checkbox"/> natural gas <input type="checkbox"/> propane <input type="checkbox"/> electricity					<input type="checkbox"/>	<input type="checkbox"/>	
A copy of the construction documents, or a comparable document confirming compliance, has been provided to the owner.					<input type="checkbox"/>	<input type="checkbox"/>	
Does installed measure and/or HERS-verified data match CF1R and meet all mandatory requirements?							
Measure	Required Forms			Notes	YES	NO	
	Form Name	CF2R	CF3R				
ADDITIONS & ALTERATIONS WITH NO HERS MEASURES							
Additions: All building features are in one report		ADD-02				<input type="checkbox"/>	<input type="checkbox"/>
Alterations: All building features are in one report		ALT-05				<input type="checkbox"/>	<input type="checkbox"/>
ENVELOPE							
Fenestration		ENV-01				<input type="checkbox"/>	<input type="checkbox"/>
Insulation		ENV-03				<input type="checkbox"/>	<input type="checkbox"/>
Roofing (cool roof, radiant barrier)		ENV-04				<input type="checkbox"/>	<input type="checkbox"/>
HERS Measures (if required) Envelope Air Leakage Quality Insulation Installation (QII)		ENV-20 & MCH-24 ENV-21, 22, 23, 24				<input type="checkbox"/>	<input type="checkbox"/>
HVAC							
Equipment		MCH-01				<input type="checkbox"/>	<input type="checkbox"/>
Whole House Fan (ventilation cooling)		MCH-02, MCH-30				<input type="checkbox"/>	<input type="checkbox"/>
Evaporative Coolers		MCH-04				<input type="checkbox"/>	<input type="checkbox"/>
HERS Measures							
Duct leakage		MCH-20				<input type="checkbox"/>	<input type="checkbox"/>
Duct location		MCH-21				<input type="checkbox"/>	<input type="checkbox"/>
Fan Efficacy		MCH-22				<input type="checkbox"/>	<input type="checkbox"/>
Airflow Rate		MCH-23				<input type="checkbox"/>	<input type="checkbox"/>
Refrigerant Charge		MCH-25				<input type="checkbox"/>	<input type="checkbox"/>
High SEER or EER		MCH-26				<input type="checkbox"/>	<input type="checkbox"/>
IAQ Ventilation		MCH 27				<input type="checkbox"/>	<input type="checkbox"/>
Return Duct and filter Grille		MCH-28				<input type="checkbox"/>	<input type="checkbox"/>
Buried Ducts		MCH-29				<input type="checkbox"/>	<input type="checkbox"/>
PLUMBING							
Distribution							
Non-HERS: Centralized system (multifamily)		PLB-01				<input type="checkbox"/>	<input type="checkbox"/>
Individual system		PLB-02				<input type="checkbox"/>	<input type="checkbox"/>
HERS: Centralized system (multifamily)		PLB-21				<input type="checkbox"/>	<input type="checkbox"/>
Individual system		PLB-22				<input type="checkbox"/>	<input type="checkbox"/>
Pools and Spas		PLB-03				<input type="checkbox"/>	<input type="checkbox"/>
Solar Hot Water		STH-01				<input type="checkbox"/>	<input type="checkbox"/>
ELECTRICAL							
PV Systems		SPV-01				<input type="checkbox"/>	<input type="checkbox"/>
Lighting: Single Family		LTG-01				<input type="checkbox"/>	<input type="checkbox"/>
Multifamily		LTG-02				<input type="checkbox"/>	<input type="checkbox"/>

