



Home Energy Rating System (HERS)

Understanding HERS in the Energy Code

General Services Department
Energy and Sustainability Division

Presenter
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Who We Are and What We Do



The Energy and Sustainability Division promotes and delivers solutions necessary to mitigate the environmental impacts and prepare for climate change.

Consulting and
Project Planning»



Site Visits and
Audits»



Financing and
Rebates»



County of Sonoma Sustainability Services

- Home and Business Retrofit and Sustainability Resources
- Sustainability Consultations
 - ✓ Green Certification
 - ✓ Consulting and Project Planning
 - ✓ PACE Financing
- Workforce Development Training
- Educational Workshops
- Municipal Project Support





Better Buildings



Educational Programs that promote Energy Efficiency Best Practices in High Performance New Construction and Existing Buildings:

- Homeowner Workshops & Consultations
- Seminars for Designers & Builders
- Contractor Workforce Development Trainings
- Contractor Tools & Resources



Homeowner Consultations

Rebuilding for Efficiency, Comfort and Resilience

- Free 90-minute consultations with on-staff Energy Analyst and Solar PV specialist
- Discuss project-specific goals
- Energy efficiency improvements for better buildings
- Rebates and incentives
- Solar PV technology

Call (707)565-6470 today to schedule a convenient time for your consultation

What is HERS?

The Home Energy Rating System (HERS) is a statewide California program that addresses the quality of construction and equipment installations in terms of compliance with Title 24, Part 6 Energy Standards.

The HERS program:

- Establishes requirements for Field Verification and Diagnostic Testing services used to show compliance
- Provides the framework for HERS Rater training, certification, and quality assurance
- Provides a consistent, accurate, and uniform rating system based on a single statewide rating scale

When is HERS Required for Residential?



- HERS will **always** be required for Residential New Construction and Additions > 1000 ft²
- Adding, altering or replacing HVAC equipment and/or ducting

2016 Title 24 HERS CF1R

2016 ENERGY CODE



Title 24, Part 6
Quick
Reference

Residential & Nonresidential HERS Measures

Residential HERS Measures

HERS Measure	Mandatory	Prescriptive	Performance*	Reference Appendices
MECHANICAL				
Duct sealing (maximum leakage)	§150.0(m)(1)			RA 3.1
Indoor air quality ventilation (consistent with ASHRAE Standard 62.2)	§150.0(a)			RA 3.7
Refrigerant charge or installation of a fault indicator display (FID)		Climate Zones 2, 8-15 §150.1(c)(2A)	X	RA 1.2, RA 3.2, RA 3.4
Duct design	§150.0(m)		X	RA 3.1

HERS FEATURE SUMMARY

The following is a summary of the features that must be field-verified by a certified HERS Rater as a condition for meeting the modeled energy performance for this computer analysis. Additional detail is provided in the building components tables below.

Building-level Verifications:

- IAQ mechanical ventilation

Cooling System Verifications:

- Minimum Airflow
- Verified EER
- Refrigerant Charge
- Fan Efficacy Watts/CFM

HVAC Distribution System Verifications:

- Duct Sealing

Domestic Hot Water System Verifications:

- -- None --

Pipe insulation			X	RA 3.8
Verified design (parallel piping, compact design, recirc control)			X	RA 3.6
Multifamily recirculation loops			X	RA 3.6
SOLAR PV				
Photovoltaic (PV) system capacity to qualify for PV rebate via New Solar Home Partnership			X	RA 4.8

* An "X" indicates "may be taken as a performance measure and must be field-verified if taken."



2016 Title 24, Part 6 - Residential & Nonresidential HERS Measures

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Nonresidential HERS Measures

HERS Measure	Mandatory	Prescriptive	Performance*	Reference Appendices
MECHANICAL				
Duct sealing (maximum leakage)		§140.6(i)		NA.1, NA.2.1, RA.3.1
Low leakage air handlers			§110.2(f)	RA.3.1, RA.3.3, JAG
PLUMBING				
Multifamily/Hotel & Motel recirculation systems (piping and controls)			X	RA 4.4
Multifamily/Hotel & Motel pipe insulation			X	RA 4.4

* An "X" indicates "may be taken as a performance measure and must be field-verified if taken."



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2016 Title 24, Part 6 - Residential & Nonresidential HERS Measures

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When is HERS not Required for Residential?



Alterations & Additions $\leq 1,000 \text{ ft}^2$:

When there are no changes to and additions to ducted HVAC system including:

- Adding a ductless wall furnace
- Extending < 40 linear ft. of ducting to an existing HVAC system
- Changing or adding a water heater
- Changing or adding lighting
- Changing or replacing envelope features that are NOT to be HERS pre-verified in a performance calculation such as window replacement and reroofs(s)

Who are HERS Providers?

- HERS Providers are organizations that the California Energy Commission (CEC) has approved to administer a HERS program.
- In addition, HERS Providers are responsible for:
 - Training and certifying HERS Raters
 - Creating and maintaining a HERS Registry, which is an online database of all building projects that require HERS inspections
 - Conducting a Quality Assurance Program on HERS Rater's work



Who are HERS Providers?

Approved HERS Provider Categories

Provider	2016 Standards		
	Newly Constructed	Alterations	Whole House
CalCERTS	Yes	Yes	Yes
CHEERS	Yes	Yes	No

2016 Building Energy Efficiency Standards and Whole-House Ratings

CHEERS

Approved Activities: Field Verification for Newly Constructed, Additions, and Alterations of Residential & Nonresidential Buildings

CalCERTS

Approved Activities: Field Verification for Newly Constructed, Additions, and Alterations of Residential & Nonresidential Buildings; California Whole-House Home Energy Ratings; HERS Building Performance Contractors.



http://www.energy.ca.gov/HERS/providers_2016standards.html



Who are HERS Raters?

- HERS Raters are a category of “special” building inspector created by the California Energy Commission.
- HERS Raters perform field verification and diagnostic testing for compliance with the Energy Standards. They are trained to do more than two dozen different inspections. This testing requires special training and equipment that general building inspectors don’t have.
- HERS raters assist the building department in enforcing the energy code. Building departments have ultimate authority over all Special Inspectors.



How to find a HERS Rater



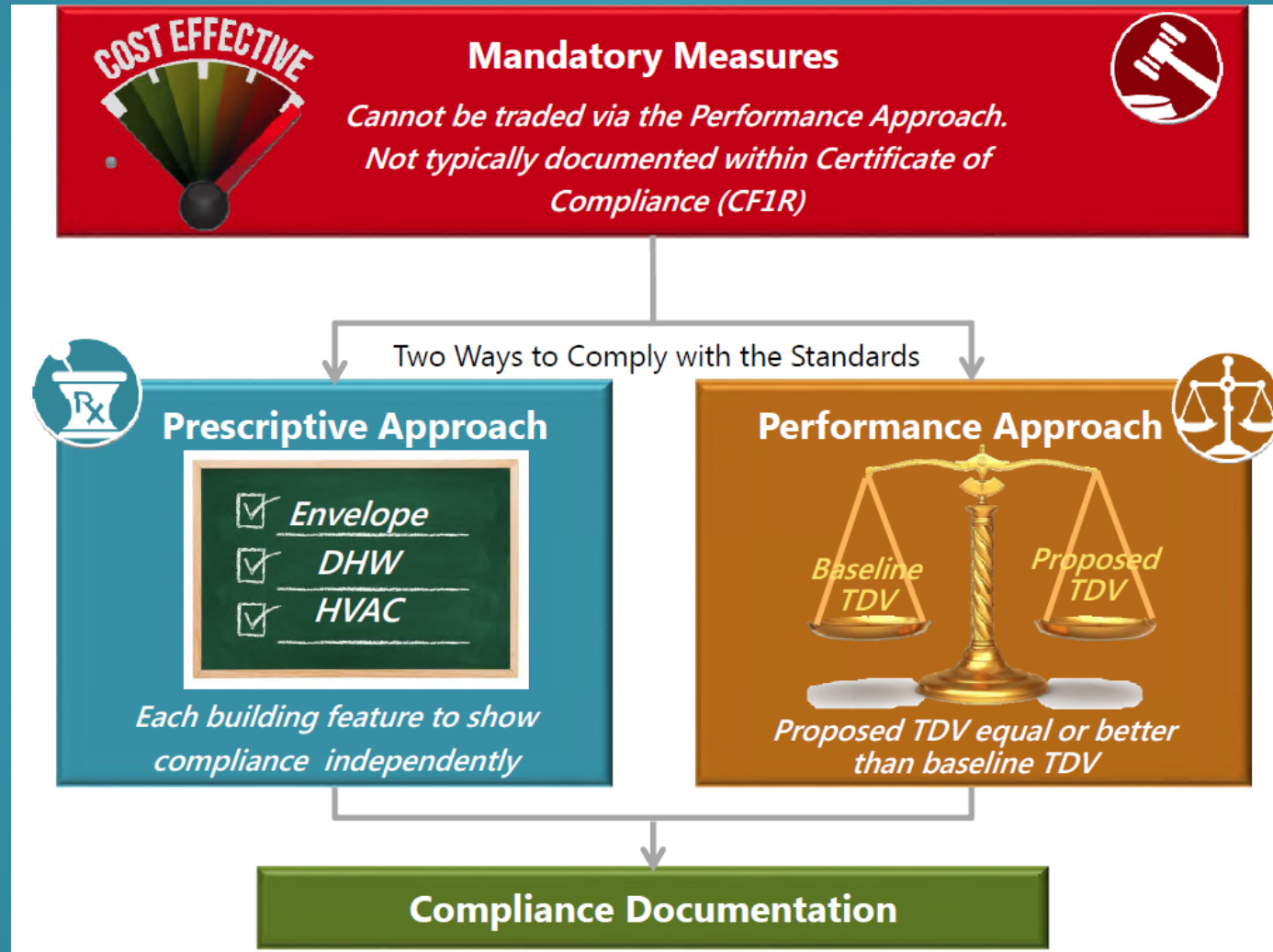
- CalCERTS Find a Rater:
- <https://www.calcerts.com/RaterSearch.php>



- CHEERS Find a Rater:
- <https://www.cheers.org/>



2016 Title 24 HERS Mandatory Measures



2016 Title 24 HERS Mandatory Measures



Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPROPRIATES
		New	Altered				
DUCT MEASURES							
DUCT SEALING	Field verification and diagnostic testing to verify approved duct system materials are utilized, and that duct leakage passes.	When	Altered	CFR 438-20.20 H §150.0(m)(1)			RA3.1.4.3 Single Family: New 1% Altered 1% Multi-Family: New 1% Altered 1%
RETURN DUCT DESIGN	Confirm that the return duct design conforms to the criteria per §150.0(m)(1) or Cooling System Airflow verification.		Altered	CFR 438-20.20 H §150.0(m)(1)			RA3.1.4.4
AIR FILTER DEVICE	Confirm that the air filter device conforms §150.0(m)(2).		Altered	CFR 438-20.20 H §150.0(m)(2)			RA3.1.4.5
ZONALLY CONTROLLED CENTRAL FAN (BYPASS DUCT)	Zonally controlled system comply with the bypass duct requirements in §150.0(m)(2). (Performance penalty if bypass ducts used.)		Altered	CFR 438-20.20 H §150.0(m)(2)	Res. Altered, §150.0(f)	Res. ACM 2.4.8.4	RA3.1.4.6
DUCTS IN INDIRECTLY CONDITIONED SPACE	Duct system location shall be verified.		Altered	CFR 438-20.20 H §150.0(m)(1)		Res. ACM 2.4.6.2	RA3.1.4.3.8
LOW LEAKAGE DUCTS IN INDIRECTLY CONDITIONED SPACE	Field verification for ducts in conditioned space is required. Duct sealing is required.		Altered	CFR 438-20.20 H §150.0(m)(1)	HFA Options, §150.0(h)	2.4.6.13	
DUCT SURFACE AREA/ R-VALUE, BURIED DUCTS/ R-VALUE BURIED DUCTS	Duct system insulation 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.		Altered	CFR 438-20.20 H §150.0(m)(1)		Res. ACM 2.4.6.6 2.4.6.7 2.4.6.10	RA3.1.4.1
LOW LEAKAGE AIR-SEALING UNITS	Verification of factory sealed air handling unit tested by the manufacturer and certified. Duct sealing is required.		Altered	CFR 438-20.20 H §150.0(m)(1)		Res. ACM 2.4.6.11 2.4.6.12	RA3.1.4.3.9
AIR CONDITIONING MEASURES							
COOLING SYSTEM AIRFLOW	System airflow greater than or equal to a specified criterion. Field verification and diagnostic testing required.		Altered	CFR 438-20.20 H §150.0(m)(1)			RA3.3
COOLING AIR HANDLING UNIT FAN EFFICACY	Fan efficacy (Watt/ft³) less than or equal to a specified criterion. Field verification and diagnostic testing required.		Altered	CFR 438-20.20 H §150.0(m)(1)			RA3.3
REFRIGERANT CHARGE	Air cooled air conditioning and air-source heat pumps. Field verification and diagnostic testing required to verify that the system has the correct refrigerant charge. Field verification and diagnostic testing required.	New AC System in CZ 2, 8-15	Altered AC System in CZ 2, 8-15			CFR 438-20.20 H §150.0(m)(1)	RA3.3 RA3.2 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

2016 Title 24 HERS Mandatory Measures

Decoding 2016 HERS™

Residential HERS Key		APPLICATION		MANDATORY	PRESCRIPTIVE	PERFORMANCE	REFERENCE APPLICANCES
		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 (CFR 90.41-4)			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	RA3.4.3, 3.3 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 only if present in §150.2(a)	CFR 90.41-4 ACH-27.8 §150.2(a)			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.		N/A			Res ACM 2.2.5.1	RA3.8
HIGH QUALITY INSULATION (QI)	Compliance credit can be taken for quality installation of insulation.	New Homes	Addition only if present in CFR 90.41-4			Res ACM 2.2.6	RA3.5
SPRAY POLYURETHANE FOAM (SPF) INSULATION	Verify the installation of SPF insulation whenever it is used other than the default R-value per inch as it used for compliance credit.		Altered Envelope Features if present in CFR 90.41-4			Res ACM 2.2.3.2	RA3.5.6
SINGLE FAMILY DOMESTIC HOT WATER MEASURES							
PIPE INSULATION CREDIT	Inspection to verify that all hot water piping in non-reticulating systems is insulated and that corners and tees are fully insulated. No piping should be within other insulation voids with the exception of the first segment of piping that penetrates walls and delivers hot water to the sink, appliance, etc.	New Homes	New HW Distribution System when used in a performance calculation (CFR 90.41-4)			Res ACM 2.9	RA3.6.3
PARALLEL PIPING	Inspection that requires that the measured length of piping between the water heater and single control manifold does not exceed five feet.						Res ACM 2.9

✦ Ventilation

✦ IAQ

- Continuous or intermittent

✦ Central Fan Integration

2016 Title 24 HERS Mandatory Measures

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

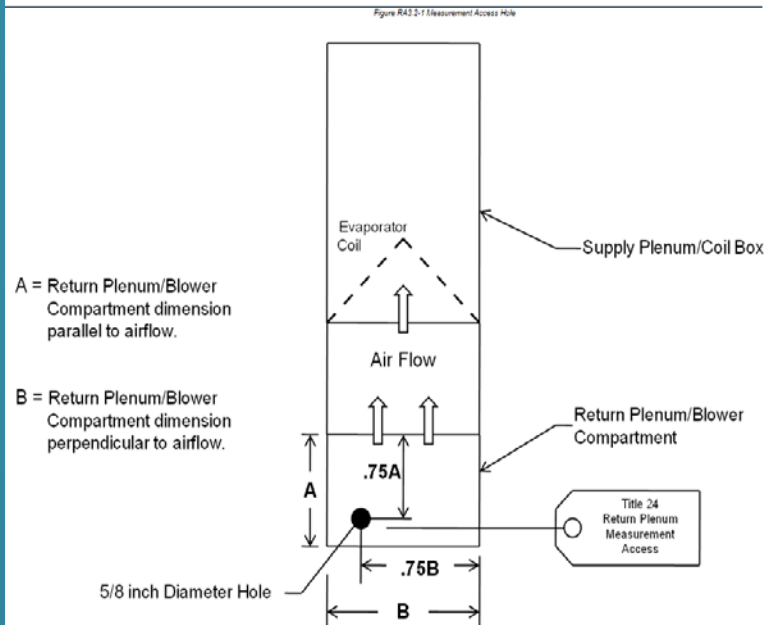
2016 Title 24 HERS Mandatory Measures

Static Pressure Probe (SPP) & Measurement Access Hole (MAH)



Static Pressure Probe

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



Description	Procedure
When Refrigerant Charge is required then, the Contractor must provide: • 5/8 inch (16 mm) diameter hole <u>Exceptions:</u> • <i>Return located entirely within conditioned space</i> • <i>Systems that cannot conform to the specifications for the hole location shown. (e.g. "pancake units")</i>	RA3.2.2.3

2016 Title 24 HERS Mandatory Measures

AC Systems: Airflow and Fan Watt Draw



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

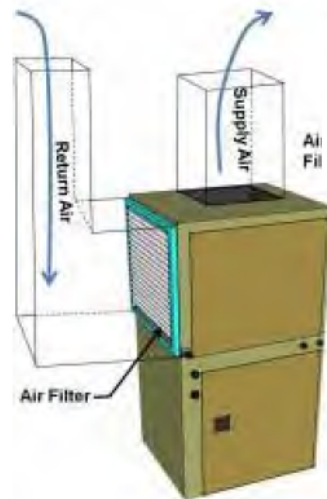


Image from Building America Solution Center

Description	Procedure
<u>Single Zone Central Forced Air Systems.</u> 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 <i>Exceptions:</i> 1. Size the return ducts per Table 150.0-C or 150.0-D and provide with MERV 6 filter as verified by HERS rater 2. Multispeed/variable speed compressors and small duct high velocity systems have additional exceptions	RA3.1.4.4-5 or RA3.3.3

2016 Title 24 HERS Mandatory Measures

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

2016 Title 24 HERS Mandatory Measures

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>

2016 Title 24 HERS Prescriptive Measures

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	Weigh-In Charge RA3.2.1.2	Charge Indicator Display 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.	✦ 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	✦ Provide real-time information to the building occupant about the status of: ✧ System refrigerant charge; ✧ Metering device; ✧ System airflow.



2016 Title 24 HERS Prescriptive Measures

Verified Ducts

Duct Option	Description	Procedure
Duct Design Layout 	Verification, per the drawings provided designed per ACCA Manual D (or equal), of: • 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  	• 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 • 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>

2016 Title 24 HERS Performance Measures

HVAC

Decoding 2016 HERS™						
Residential HERS Key		APPLICATION		MANDATORY	PREScriptive	PERFORMANCE
		New	Altered			REFERENCE APPENDICES
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.		Altered AC system when used in a performance calculation (CFR-PHF-08-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.	New AC System				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.	CFR-CFR-110-27-B §150.2(a)		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.		N/A			Res ACM 2.2.5.1 RA3.8
HIGH QUALITY INSULATION (HQI)	Compliance credit can be taken for quality installation of insulation.	New Homes	Addition only if present in CFR-PHF			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 CFR-PHF			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-ventilating systems is insulated and that covers and tees are fully insulated. No piping should be visible due to insulation voids with the exception of the last segment of piping that penetrates walls and delivers hot water to the sink, appliances, etc.	New Homes	New HW Distribution System when used in a performance calculation (CFR-PHF-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.

2016 Title 24 HERS Performance Measures

Envelope



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 (CFR-PHF-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	RA3.4.3/4.1 3.2
MECHANICAL VENTILATION MEASURES							
CONTINUOUS OR INTERMITTENT IAQ	Measurement of whole-building mechanical ventilation, if central fan integrated systems used, verification of installation and intermittent controls.	New Homes	Addition over 1,000 sq. ft.	CFR-PHF-01-E NCH-27.8 §150.0(c)			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 (QII)	Compliance credit can be taken for quality installation of insulation.		Addition only if present in CFR-PHF			Res ACM 2.2.6	RA3.9
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 CFR-PHF			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-ventilating 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 penetrates walls and delivers hot water to the sink, appliances, etc.	New Homes	New HW Distribution System when used in a performance calculation (CFR-PHF-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 • 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" • Open cell: R-value=3.6/inch • Closed cell: R-value=5.8/inch

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 - 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" - Open cell: R-value=3.6/inch - Closed cell: R-value=5.8/inch

HERS Verified Quality Insulation Installation (QII)

- Independent 3rd party verification by HERS rater
- Includes field verification of Air Infiltration Sealing at the Framing Stage (CF3R-ENV-22-H & CF3R-ENV-23-H)



AND

- Quality of Insulation Installation at the Insulation Stage
- Improved comfort and energy savings
- California Energy Commission (CEC) assumes 13% penalty for standard installation



HERS Verified Quality Insulation Installation (QII)

Compliance Documentation

- CF3R HERS Certificates of Verification
 - Online via HERS registry
 - Residential Compliance Manual – Appendix A
 - California Energy Commission – Single Forms:
- <http://www.energy.ca.gov/2015publications/CEC-400-2015-032/appendices/forms/CF3R/>

HERS Verified Quality Insulation Installation (QII)

- Framing Stage

STATE OF CALIFORNIA		CALIFORNIA ENERGY COMMISSION	
AIR INFILTRATION SEALING – FRAMING STAGE FOR BATT, LOOSE FILL, AND SPF		CF3R-ENV-21-H	
CEC-CF3R-ENV-21-H (Revised 04/17)		CF3R-ENV-21-H	
CERTIFICATE OF VERIFICATION		(Page 1 of 4)	
Quality Insulation Installation (QII) – Air Infiltration Sealing - Framing Stage for Batt, Loose Fill, and SPF			
Project Name:	Enforcement Agency:	Permit Number:	
Dwelling Address:	City:	Zip Code:	

A. Air Infiltration and Insulation Installation (QII) – Framing Stage	
01	The requirements below cover the required air sealing and installation of insulation that must occur in the framing stage.
02	An air barrier is required in all thermal envelope assemblies to limit air movement between unconditioned/outside spaces and conditioned/inside spaces and must meet one of the following: 1. Using individual materials that have an air permeance not exceeding 0.004 cfm/ft ² under pressure differential of 0.3 in w.g. (1.57 psf) (0.02 L/s.m ² at 75 pa) when tested in accordance with ASTM E2178; or • A list of example materials meeting the air permeance testing performance levels of 1 above is available in RA3.5.2. 2. Using assemblies of materials and components that have an average air leakage not to exceed 0.04 cfm/ft ² under a pressure differential of 0.3 in w.g. (1.57 psf) (0.2 L/s.m ² at 75 pa) when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680 or ASTM E283; or 3. Testing the complete building and demonstrating that the air leakage rate of the building envelope does not exceed 0.4 cfm/ft ² at a pressure differential of 0.3 in w.g. (1.57 psf) (2.0 L/s.m ² at 75 pa) in accordance with ASTM E779 or an equivalent approved method.
03	Air Barrier Material Installed
04	Verification Status: ☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable.
05	Correction Notes:
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.	

B. Raised Floor Air Barrier	
01	All gaps in the raised floor are sealed.
02	All chases sealed at floor level using a hard cover and the hard cover is sealed.
03	All plumbing and electrical wires that penetrate the floor are sealed.
04	Subfloor sheathing is glued or sealed at all exterior panel edges to create a continuous air tight subfloor.
05	Verification Status: ☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable.
06	Correction Notes:
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.	

C. Walls/Knee Wall Air Barrier	
01	All penetrations through the exterior wall air barrier are sealed to provide an air-tight envelope to unconditioned spaces such as the outdoors, attic, garage, and crawl space.
02	Exterior wall air barrier is sealed to the top plate and bottom plate in each stud bay.
03	All electrical boxes including knockouts that penetrate the air barrier to unconditioned space are sealed.
04	All openings in the top and bottom plate, including all interior and exterior walls, to unconditioned space are sealed; such as holes drilled for electrical and plumbing.
05	Exterior bottom plates (all stories) are sealed to the floor using the appropriate sealing method.
06	All gaps around windows and doors are sealed. The sealant used follows window manufacturer specifications.
07	Rim joists gaps/openings are fully sealed.
08	Fan exhaust ducts that run between conditioned floors to exterior walls including damper at the exterior wall.
09	Metal tie downs are insulated between exterior framing and tie down.
10	Hard to access wall stud cavities, such as corner channels or wall intersections, are insulated to the proper R-value prior to the installation of exterior sheathing or exterior stucco lath.
11	Insulation is installed behind tub, shower, or fireplace enclosures, and exterior stairwells to the R-value listed on the CF1R when located against exterior walls. Insulation is installed before tub, shower, and fireplace are installed.
12	A solid air barrier is installed, from floor to ceiling, on the inside of exterior walls directly adjacent to tub, shower, or fireplace enclosures. Insulation shall contact all six sides of the air barrier on exterior walls.

Registration Number:	Registration Date/Time:	HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance		April 2017

HERS Verified Quality Insulation Installation (QII)

- Framing Stage

STATE OF CALIFORNIA AIR INFILTRATION SEALING – FRAMING STAGE FOR BATT, LOOSE FILL, AND SPF CEC-CF3R-ENV-21-H (Revised 04/17) CALIFORNIA ENERGY COMMISSION	
CERTIFICATE OF VERIFICATION	
Quality Insulation Installation (QII) – Air Infiltration Sealing - Framing Stage for Batt, Loose Fill, and SPF (Page 1 of 4)	
Project Name:	Enforcement Agency:
Dwelling Address:	City:
	Zip Code:
A. Air Infiltration and Insulation Installation (QII) – Framing Stage	
01	The requirements below cover the required air sealing and installation of insulation that must occur in the framing stage.
02	An air barrier is required in all thermal envelope assemblies to limit air movement between unconditioned/outside spaces and conditioned/inside spaces and must meet one of the following: 1. Using individual materials that have an air permeance not exceeding 0.004 cfm/ft ² under pressure differential of 0.3 in w.g. (1.57 psf) (0.02 L/s.m ² at 75 pa) when tested in accordance with ASTM E2178; or • A list of example materials meeting the air permeance testing performance levels of 1 above is available in RA3.5.2. 2. Using assemblies of materials and components that have an average air leakage not to exceed 0.04 cfm/ft ² under a pressure differential of 0.3 in w.g. (1.57 psf) (0.2 L/s.m ² at 75 pa) when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680 or ASTM E283; or 3. Testing the complete building and demonstrating that the air leakage rate of the building envelope does not exceed 0.4 cfm/ft ² at a pressure differential of 0.3 in w.g. (1.57 psf) (2.0 L/s.m ² at 75 pa) in accordance with ASTM E779 or an equivalent approved method.
03	Air Barrier Material Installed
04	Verification Status: ☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable.
05	Correction Notes:
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.	
B. Raised Floor Air Barrier	
01	All gaps in the raised floor are sealed.
02	All chases sealed at floor level using a hard cover and the hard cover is sealed.
03	All plumbing and electrical wires that penetrate the floor are sealed.
04	Subfloor sheathing is glued or sealed at all exterior panel edges to create a continuous air tight subfloor.
05	Verification Status: ☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable.
06	Correction Notes:
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.	
C. Walls/Knee Wall Air Barrier	
01	All penetrations through the exterior wall air barrier are sealed to provide an air-tight envelope to unconditioned spaces such as the outdoors, attic, garage, and crawl space.
02	Exterior wall air barrier is sealed to the top plate and bottom plate in each stud bay.
03	All electrical boxes including knockouts that penetrate the air barrier to unconditioned space are sealed.
04	All openings in the top and bottom plate, including all interior and exterior walls, to unconditioned space are sealed; such as holes drilled for electrical and plumbing.
05	Exterior bottom plates (all stories) are sealed to the floor using the appropriate sealing method.
06	All gaps around windows and doors are sealed. The sealant used follows window manufacturer specifications.
07	Rim joists gaps/openings are fully sealed.
08	Fan exhaust ducts that run between conditioned floors to exterior walls including damper at the exterior wall.
09	Metal tie downs are insulated between exterior framing and tie down.
10	Hard to access wall stud cavities, such as corner channels or wall intersections, are insulated to the proper R-value prior to the installation of exterior sheathing or exterior stucco lath.
11	Insulation is installed behind tub, shower, or fireplace enclosures, and exterior stairwells to the R-value listed on the CF1R when located against exterior walls. Insulation is installed before tub, shower, and fireplace are installed.
12	A solid air barrier is installed, from floor to ceiling, on the inside of exterior walls directly adjacent to tub, shower, or fireplace enclosures. Insulation shall contact all six sides of the air barrier on exterior walls.
Registration Number: CA Building Energy Efficiency Standards - 2016 Residential Compliance	
Registration Date/Time:	
HERS Provider:	
April 2017	

HERS Verified Quality Insulation Installation (QII)

- Framing Stage (SIP and ICF)

STATE OF CALIFORNIA AIR INFILTRATION SEALING – FRAMING STAGE FOR SIP and ICF CEC-QF3R-ENV-24-H (Revised 5/1/15)			CALIFORNIA ENERGY COMMISSION
CERTIFICATE OF VERIFICATION			CF3R-ENV-24-H
Quality Insulation Installation (QII) – Air Infiltration Sealing - Framing Stage for SIP and ICF			(Page 1 of 4)
Project Name:	Enforcement Agency:	Permit Number:	
Dwelling Address:	City:	Zip Code:	
<i>NOTE: If there are any traditional stick built exterior walls use the CF3R-ENV-21. For traditional stick built roof/ceiling use the CF3R-ENV-22 and 23.</i>			
A. Installation			
01 The R-value of all SIP/ICF products is the same or better than listed on the CF1R.			
02 If modeled on the CF1R, the density of the installed product is the same as installed.			
03 SIP/ICF products have been installed per manufacturer installation instructions.			
04 Verification Status:	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable.		
05 Correction Notes:			
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.			
B. Raised Floor			
01 All gaps in the raised floor are sealed.			
02 All chases sealed at floor level using a hard cover, and the hard covers are sealed.			
03 All plumbing and electrical wires that penetrate the floor must be sealed.			
04 Subfloor sheathing is glued or sealed at all exterior panel edges, to create a continuous air tight subfloor.			
05 Verification Status:	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable.		
06 Correction Notes:			
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.			
C. Walls/Knee Walls			
01 Exterior walls are sealed to every floor on every story.			
02 All gaps around windows and doors are sealed. Proper sealant used was as specified by window manufacturer.			
03 All gaps around windows and doors are filled with insulation. Batt insulation is not allowed to be stuffed into gap.			
04 All plumbing and wiring penetrations through the top and bottom of panels, and electrical boxes that penetrate the wall are sealed.			
05 All SIP panel joints sealed at the interior of the wall and the exterior of each panel.			
06 Fan exhaust ducts that run between conditioned floors to exterior walls must include a damper at the exterior wall.			
07 Header sealed to wall with continuous foam, or caulk per manufacturer directions.			
08 Knee walls have solid and sealed blocking at the bottom, top, left side and right side of the knee wall.			
09 Verification Status:	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable.		
10 Correction Notes:			
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.			
D. SIP Ceiling			
01 For vented attics use the CF3R-ENV-22.			
02 For non-vented attics ensure all penetrations through the roof deck and gable ends are sealed and air tight.			
03 Verification Status:	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable.		
04 Correction Notes:			
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.			
Registration Number:		Registration Date/Time:	HERS Provider:
CA Building Energy Efficiency Standards - 2016 Residential Compliance			January 2016

- Insulation Stage

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

2016 Title 24 HERS Performance Measures

Plumbing

Decoding * 2016 HERS™

Residential HERS Key

APPLICATION

New

Altered

MANDATORY

PRESCRIPTIVE

PERFORMANCE

REFERENCE APPENDICES

AIR CONDITIONING MEASURES

CFR 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 (CFR-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.

CFR/CFR-MCH-27.41 \$150.00(a)

Res ACM 2.7.4.1
2.7.4.2

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

RA1.8

HIGH QUALITY INSULATION INSTALLATION (HQI)

Compliance credit can be taken for quality installation of insulation.

New Homes

Addition only if present in CFR-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.

New Homes

Altered Envelope Features if present in CFR-PRF

Res ACM 2.3.3.2

RA3.5.6

SINGLE FAMILY DOMESTIC HOT WATER MEASURES

CFR 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 verified 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 (CFR-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

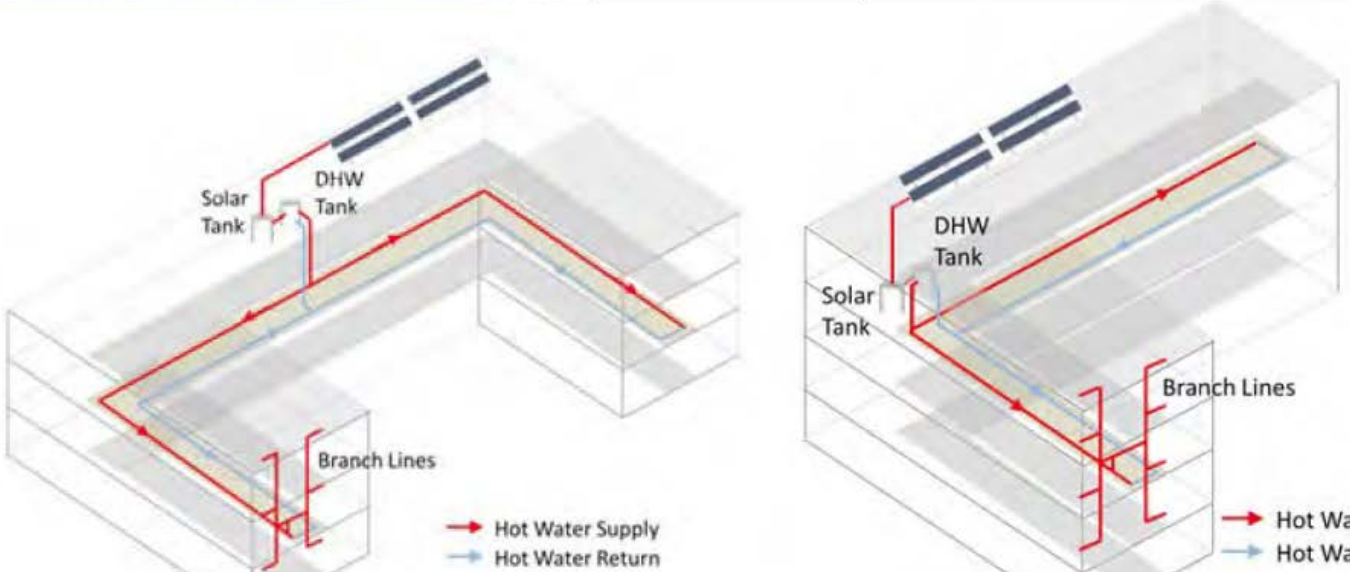
- Manual
- Sensor

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

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

2016 Title 24 HERS Performance Measures

Plumbing

	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>
			

2016 Title 24 HERS Performance Measures

Residential Existing Building Features Verified

Decoding 2016 HERS™	
Residential HERS Key	
APPLICATION	MANDATORY
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
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 dimensions from a water heater
New	New HW Distribution System when used in a
Res ACM 2.9	RA3.6.5
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.

2016 Title 24 HERS Nonresidential Performance Measure

Duct Testing

Duct Testing



★ 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: • New Duct Systems: 6% • Altered Duct Systems: 15% • or "I did the best I can" as verified by a smoke test with HERS rater	NA2.1.4

2016 Title 24 HERS Registry Project Status Report

Final Inspection should not be requested/completed until HERS Registry Project Status Report shows
“ALL GREEN DOTS”

CalCERTS

CHEERS



2016 Title 24 HERS Registry Project Status Report

Final Inspection should not be requested/completed until HERS Registry Project Status Report shows
“ALL GREEN DOTS”

CalCERTS

CHEERS

2016 Title 24 HERS Registry

Resources & Technical Support

CHEERS

- CHEERS HERS Registry Tutorials
<https://www.youtube.com/channel/UCIghmcBiTTedtOU2v-7WYwA>

CalCERTS

- field@calcerts.com - code and verification requirements
- tech@calcerts.com - issues pertaining to registry operations
- CalCERTS Registry User Manual
<https://www.calcerts.com/calcerts-releases-two-changes-to-the-registry-updated-user-manual>



Energy Code Ace



HERS Resources & Technical Support

- Decoding 2016 HERS: Let's Talk Residential and Nonresidential HERS Measures
- Fact Sheet: Just the Basics: HERS for Residential and Nonresidential Projects
- Quick Reference Sheet: HERS for Residential and Nonresidential Projects
- Decoding QII: Let's Talk HERS Quality Insulation Installation

<https://energycodeace.com>



HERS Testing & Verification – Recipe for Success

HERS failures cost time and money \$\$\$\$\$

- Additional HERS rater time and testing
- Additional Energy Consultant and Design team and Contractor time if passing HERS verification for a specific measure is not possible

Best ways to succeed and pass HERS verification:

Coordinate with project's HERS rater prior to construction to understand all HERS requirements for project

- Education and Training!
 - Architects/Designers
 - Include clear details in the plans
 - Energy Consultants & Contractors
 - Attend HERS measurement and verification trainings
 - Installing Contractors
 - Pre-test and verify installed systems
 - Review applicable HERS CF3R verification compliance forms prior to installation to understand requirements



Workforce Development Tools for Contractors and Raters

- Free Tool Lending Library
- Includes calibrated HERS testing equipment
- Loaned free to qualified borrowers including:
 - Installing Contractors
 - HERS Raters

Pilot Coming Soon: Online Tool Checkout through the web portal

For more information about the Tool Lending Library and to request tools:

- <http://sonomacounty.ca.gov/energy>





Tool Lending Library (TLL) HERS Test Equipment

Calibrated HERS Test Equipment

- Calibrated per the Instrument Specifications 2016 Building Energy Efficiency Standards
 - Appendix RA3 – Residential Field Verification and Diagnostic Test Protocols

Airflow Measurement Apparatus in the TLL

- Listed in the California Energy Commission (CEC) Listing of Manufacturer Certified Equipment, Products and Devices Classification
- Manufacturers certify to the Energy Commission that the listed equipment, products or devices meet the indicated requirements under Title 24, Part 6 and associated appendices.
 - http://www.energy.ca.gov/title24/equipment_cert/



Fall 2018

Education and Training Programs

The County of Sonoma Energy and Sustainability Division and Sonoma Clean Power are partnering with PG&E to bring the following training series to the North Coast Builders Exchange in Santa Rosa.

Free 5-part Training Series In Santa Rosa At The North Coast Builders Exchange:
Integrated Design And Construction Series: Rebuilding For Comfort, Durability And Energy Efficiency

- **Session One:** Friday, October 12, 2018, 12:00 pm to 4 pm
Design Thinking for Zero Net Energy - Rebuilding for Comfort, Efficiency, and Affordability
Instructor: Ann Edminster
- **Session Two:** Friday, October 19, 2018, 12:00 pm to 4 pm
Water, Energy and Time Efficient Hot Water Systems for New Homes
Instructor: Gary Klein
- **Session Three:** Friday, October 26, 2018, 12:00 pm to 4 pm
Water, Energy and Time Efficient Hot Water Systems for New Homes
Instructor: Gary Klein
- **Session Four:** Friday, November 2, 2018, 12:00 pm to 4 pm
High Performance Enclosures: Air Tight, Well-Insulated, Properly Ventilated
Instructor: Mike MacFarland
- **Session Five:** Friday, November 9, 2018, 12:00 pm to 4 pm
Residential Heating, Ventilation, and Air Conditioning (HVAC): Small Heat Pumps and Small Furnaces – High Efficiency and More Affordable
Instructor: Rick Chitwood

To register go to www.pge.com/energyclasses. On the left side of the page go to the location menu, scroll down and check Santa Rosa, then click on the box above that says “FILTER”.

For more information: <http://sonomacounty.ca.gov/energy>



More Fall 2018

Education and Training Programs

All trainings are free and take place at the North Coast Builders Exchange

- September 18 – **Hands-On Installer Training: High Performance Attics (HPA)**
 - <https://www.wisewarehouse.org/event/hands-on-installer-training-high-performance-attics/>
- September 19 – **Hands-On Installer Training: High Performance Walls (HPW)**
 - <https://www.wisewarehouse.org/event/hands-on-installer-training-high-performance-walls/>
- December 4, 2018 – Title 24 Part 6 Essentials – Residential Standards for Plans Examiners and Building Inspectors
 - Register: <http://usi.pge.com/event-details?EventID=19695>
- December 7, 2018 - Tiny Houses: A sustainable, Eco-Friendly and Affordable Housing Solution
 - Registration Information Coming Soon:
 - <http://sonomacounty.ca.gov/energy>



Contact Us...

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Thank you!