

Decoding HERS:

Let's Talk Residential and Nonresidential HERS Measures

Host:

Gina Rodda
Gabel Associates, LLC

Guest Speaker:

Russ King
Benningfield Group



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.



Welcome

► Welcome

- Who are we?
 - Our goal today
 - More about you
-
- What We Heard From you
 - Let's Talk
 - Next Steps
 - Wrap Up





Who Are We?



Host

Gina Rodda, Gabel Associates, LLC

gina@gabelenergy.com

Gina Rodda, our host for the Decoding Talk series, is a Certified Energy Analyst (CEA), Certified Energy Plans Examiner (CEPE) 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, through the course of seven California building energy code cycles.



GABEL ASSOCIATES, LLC

BUILDING ENERGY ANALYSIS & ENERGY CODE COMPLIANCE



Who Are We?



Co-Host

Russ King, Benningfield Group

Russ.king@benningfieldgroup.com

Russell King, M.E. is a professional mechanical engineer licensed in California, Nevada, Colorado and Hawaii. He has over 23 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. He is one of very few licensed mechanical engineers that specialize in HVAC and energy design in residential buildings.

Russ is a BPI certified Analyst, Envelope Specialist, and Multi-family Specialist with a Bachelor of Science Degree in Environmental Resources Engineering (Energy Resources Emphasis) from Humboldt State University.

BenningfieldGroup
[energy, software, service]



Our Goal Today



Review HERS measures under the 2013 energy standards:

- ✦ When they are required
- ✦ What they entail
- ✦ Tips and tricks
- ✦ Any specific questions you may have



Brought to you by...

California Statewide Codes & Standards



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Recording For Future Use

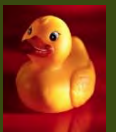
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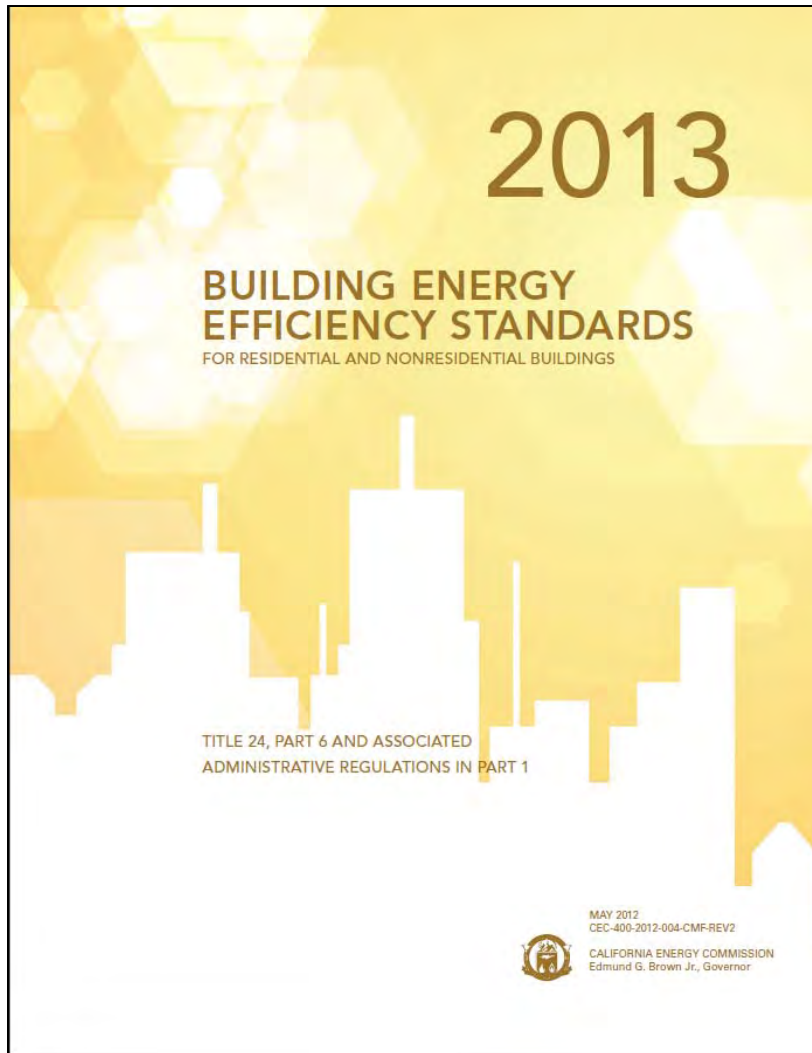
Who Are You?

We would like to know
more about you.





CEC Documents



Energy Standards

- ✦ HERS triggers
 - ✦ Mandatory
 - ✦ Prescriptive
 - ✦ Performance

<http://www.energy.ca.gov/title24/2013standards/index.html>



CEC Documents

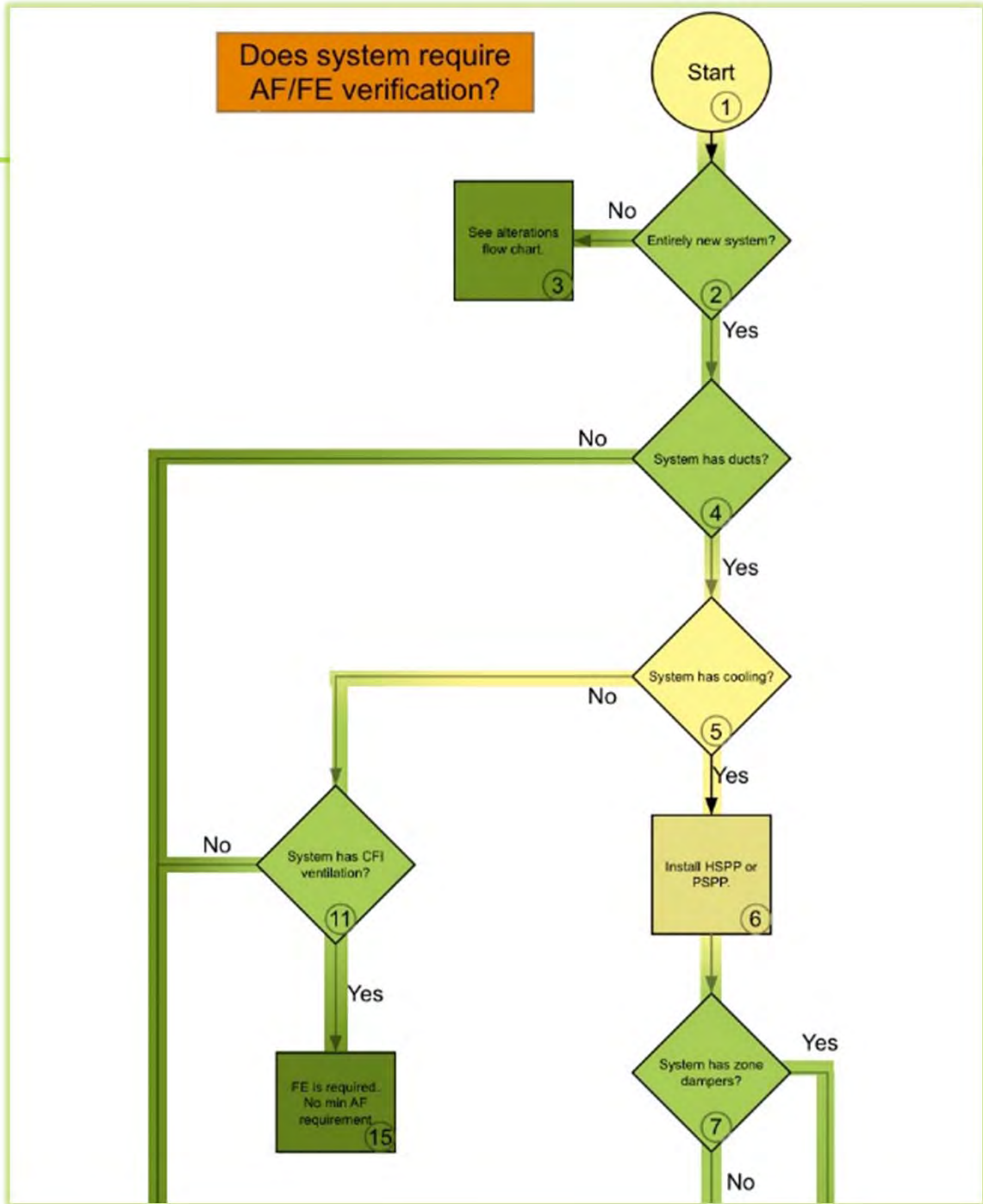


Manuals

- ✦ Full explanation of HERS:
 - ✦ Triggers
 - ✦ Exceptions
 - ✦ Requirements
 - ✦ Documentation
 - ✦ Pretty Pictures
 - ✦ Appendix E

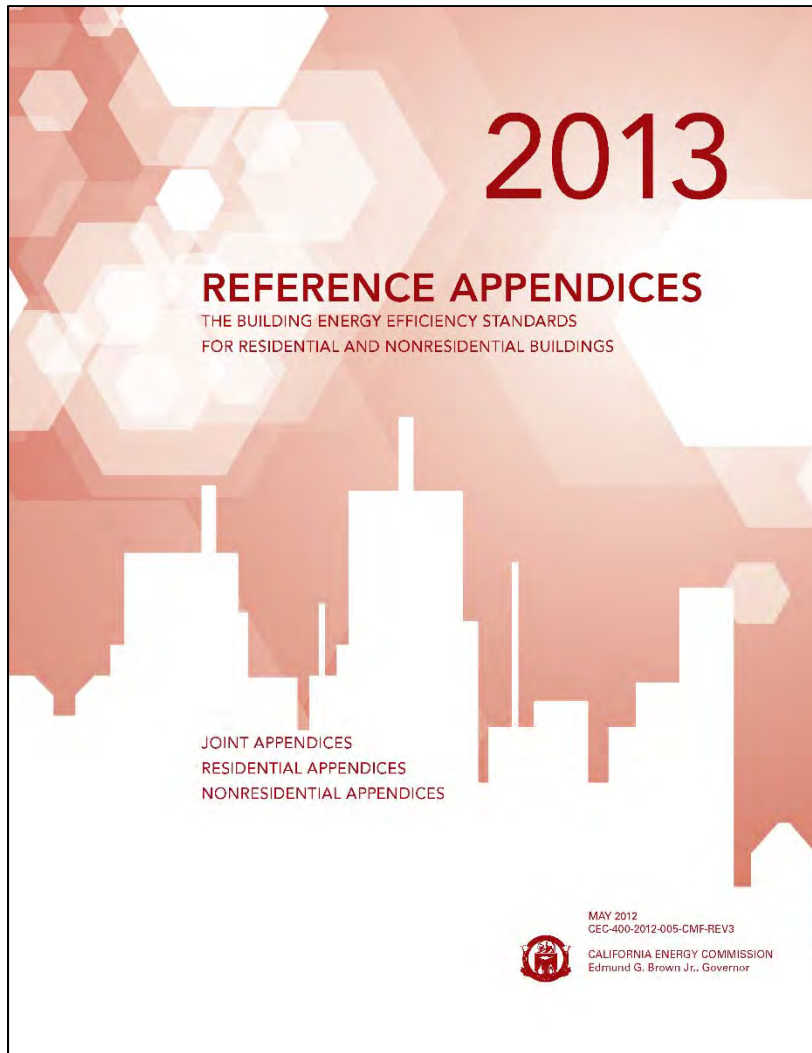


Appendix E





CEC Documents



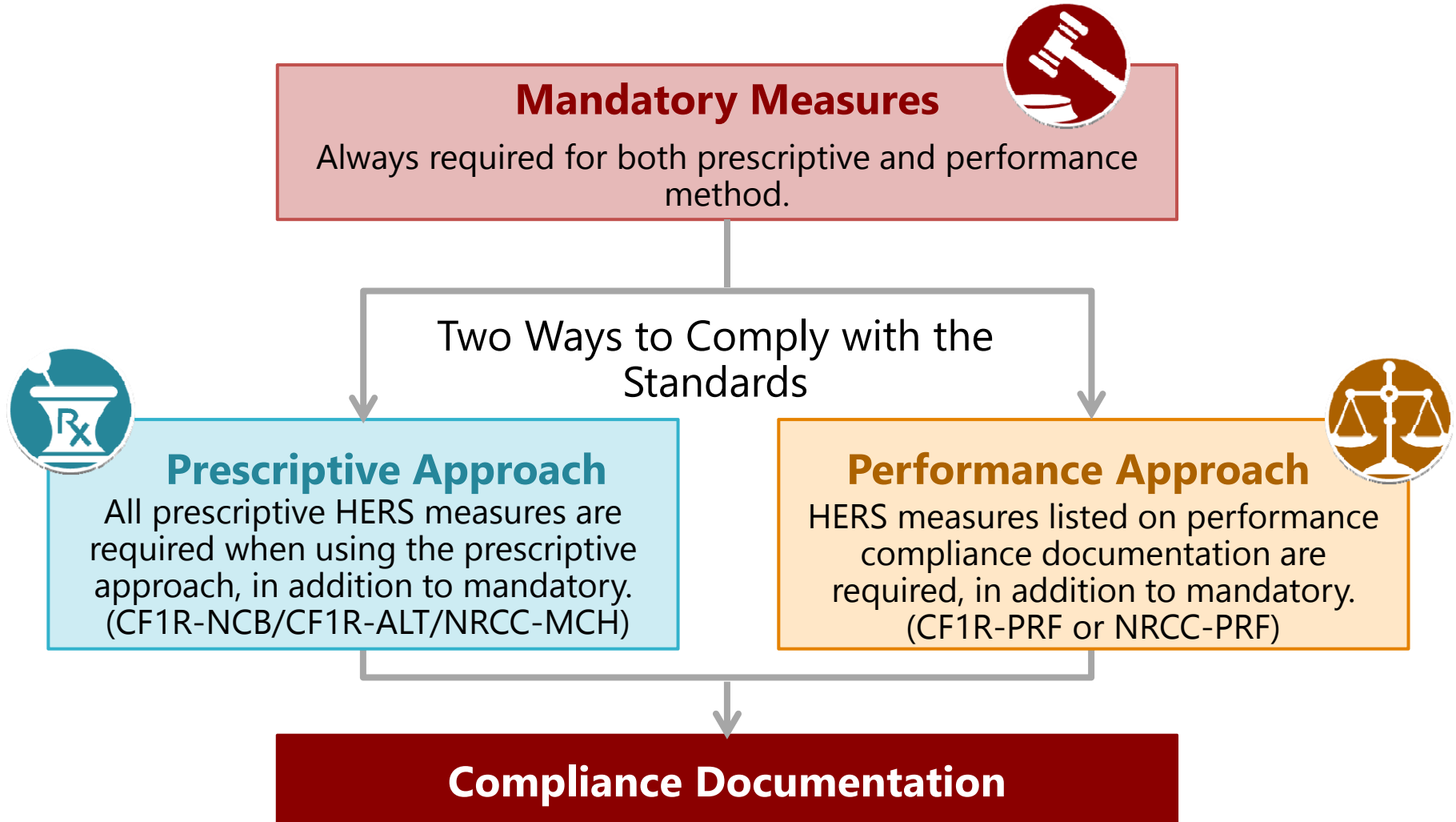
Appendices

- ✦ Joint
- ✦ Residential
 - ✦ RA1: Special Case Refrigerant Charge
 - ✦ RA2: Procedures
 - ✦ RA3: Protocols
- ✦ Nonresidential
 - ✦ NA1: Procedures
 - ✦ NA2: Protocols

<http://www.energy.ca.gov/title24/2013standards/index.html>



Defining the Difference: Compliance

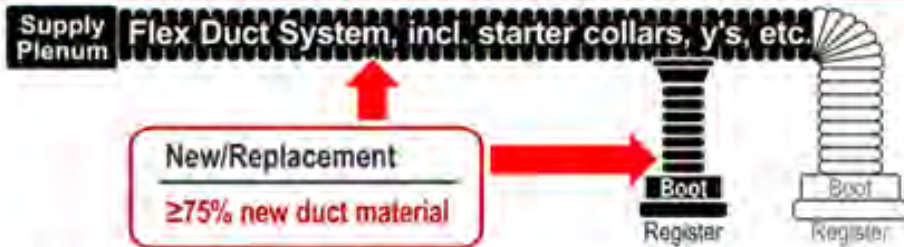




Defining the Difference: "Altered" Ducts

2013 Altered or Replaced Duct Systems (Duct Sealing)

§150.2(b)1D



Entirely New or Complete Replacement Ducts

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

The Duct Sealing and Testing HERS measure must demonstrate a leakage rate less than or equal to 6% of the system air handler airflow. In addition, verification of Cooling Coil Airflow and Fan Watt Draw (HERS measure) is required. The system must have airflow >350 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy ≤0.58 W/CFM.

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

The Duct Sealing and Testing HERS measure must demonstrate a leakage rate less than or equal to 6% of the system air handler airflow. In addition, verification of Cooling Coil Airflow and Fan Watt Draw (HERS measure) is required. The system must have airflow >350 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy ≤0.58 W/CFM.

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

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



Alteration or Extension of Existing Ducts

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

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

or

- ✦ CF2R-MCH-25f-E (for packaged systems with refrigerant charge certified by manufacturer)
- * *Correct version (e.g., "a" or "b" or "c") varies depending upon the project scope and approach used to demonstrate compliance*

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

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

- † CF2R-MCH-28-H and CF3R-MCH-28-H



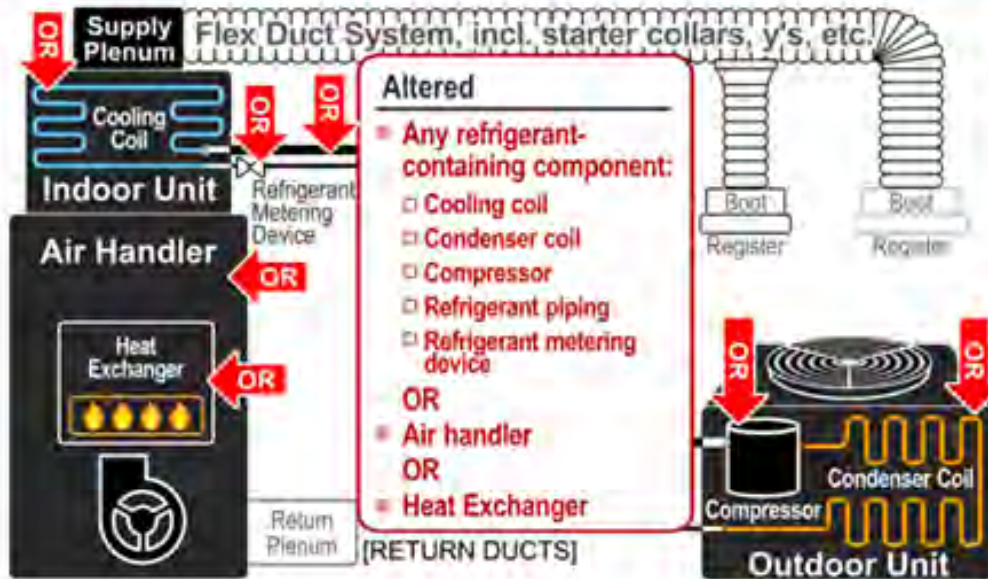
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Defining the Difference: "Altered" System

2013 Altered Space-Conditioning System

§150.2(b)1E, F



A space-conditioning system is considered altered when it is not a new or replacement system and any of the following components is installed or replaced:

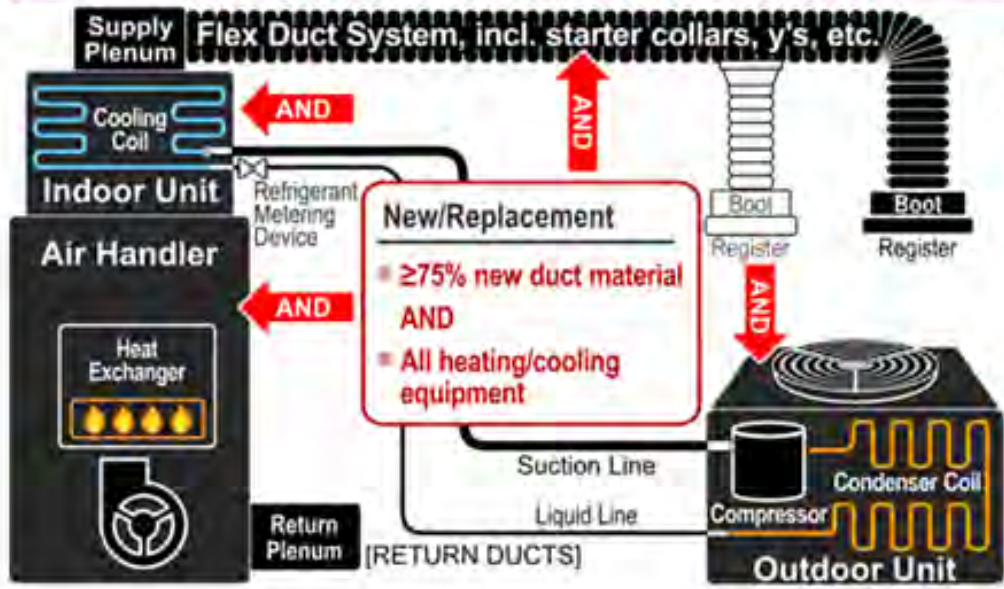
- ✦ Any refrigerant-containing component, including:
 - ❖ Cooling coil
 - ❖ Condenser coil
 - ❖ Compressor
 - ❖ Refrigerant piping
 - ❖ Refrigerant metering device
- ✦ Air handler
- ✦ Heat exchanger

Replacing other components is considered a repair — not an alteration. For example, replacing the blower wheel fan, but not the heat exchanger or air handler in the furnace, is a repair.



Defining the Difference "Entirely New" System

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



New/Replacement

- ≥75% new duct material
- AND
- All heating/cooling equipment

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

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



Let's Talk

- Welcome

▶ **We Want To Hear from You**

- Most common challenges

- Let's Talk
- Next Steps
- Wrap Up





Our Question To You



What is your top concern regarding 2013 HERS measures for Residential and Nonresidential construction?

There are so many HERS measures, how do I figure what is needed and when?

Is HERS required on every house?



Let's Talk

- Welcome
- What We Heard from You

▶ Let's Talk

- Challenge A: Residential Mandatory HERS Measures
- Challenge B: Residential Prescriptive/Performance HERS Measures
- Challenge C: Nonresidential Prescriptive/Performance HERS Measures
- Challenge D: HERS Sampling

- Next Steps
- Wrap Up





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

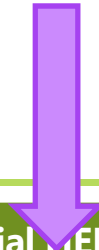


Challenge A





HERS Measures



| 2013 Residential HERS Measures | | | | |
|--|-------------|---------------------------|---------------|------------------------|
| Measure | Mandatory | Prescriptive | Performance | Reference Appendices # |
| Mechanical | | | | |
| Duct sealing (maximum leakage) | §150.0(m)11 | | | 3.1 |
| Indoor air quality ventilation (consistent with ASHRAE Standard 62.2) | §150.0(o) | | | 3.7 |
| Refrigerant charge or Installation of a charge indicator display (CID) | | CZ 2, 8-15 §150.1(c)7A | CZ 1, 3-7, 16 | 1.2, 3.2 |
| Duct design (reduced surface area, high insulation, and duct location) | | | X | 3.1 |
| Ducts entirely in conditioned space | | §150.1(c)9 | X | 3.1 |
| Low leakage ducts entirely in conditioned space | | | X | 3.1 |
| Ducts <12 feet outside conditioned space | | | X | 3.1 |
| Low leakage air handlers | | | X | 3.1 |
| Cooling coil air flow and air handler fan watt draw OR Verified return duct design and air filter device | §150.0(m)13 | | | 3.1, 3.3 |
| High SEER and/or High EER | | | §150.1(b)4B | 3.4 |
| Photovoltaic (PV) system capacity to qualify for PV rebate via New Solar Home Partnership | | | X | 4.6 |
| Central fan integrated ventilation cooling systems | | §150.1(C)10 | | 3.3 |
| Zonal control for compliance credit | | | X | 3.3 |
| Evaporatively cooled condensers | | | X | 3.1, 3.2, 3.4 |
| Ice storage air conditioners | | | X | 4.3 |
| Envelope | | | | |
| Quality insulation installation (QII) | | | X | 3.5 |
| Building envelope sealing | | | X | 3.8 |
| Plumbing | | | | |
| Pipe insulation | | | X | 3.6 |
| Verified design (parallel piping, compact design, point of use) | | | X | 3.6 |
| Multi Family recirculation loops | | | X | 3.6 |



Mandatory HERS Measures

IAQ Ventilation

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

Duct Testing

- ◆ Section 150.0(m)11
 - ◆ New systems > 10 ft. ducting
 - ◆ Altered systems with >25 ft. ducting in unconditioned space

Air Flow/Fan watt Draw

- ◆ Section 150.0(m)13
 - ◆ New ducted systems with AC
 - ◆ Altered *entirely* new systems with AC

Zonally Controlled Central FAU

- ◆ Section 150.0(m)15
 - ◆ New central forced AC systems



IAQ Ventilation

IAQ Ventilation

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



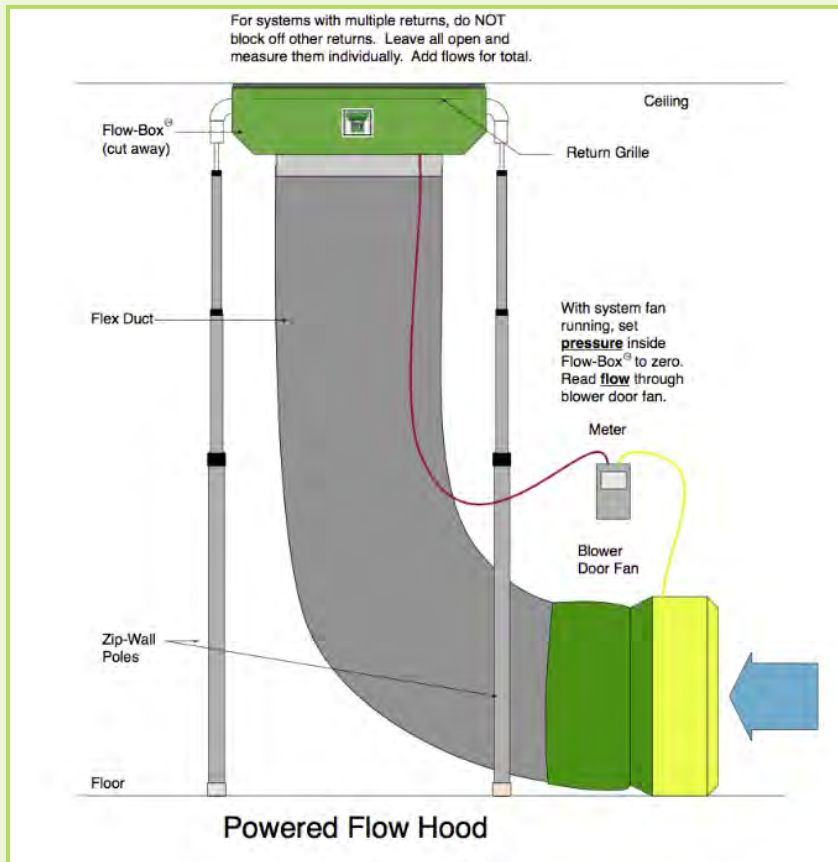
| Diagnostic | Description | Procedure |
|--|--|-----------------------------------|
| Whole-Building Mechanical Ventilation Airflow | Verify that whole-building ventilation system complies with the airflow rate required by ASHRAE Standard 62.2. | RA7.4.1 Continuous Operation |
| | | RA7.4.2 Intermittent Operation |



Photo Courtesy of Retrotec.com

Tools Used

- ✦ **Residential Mechanical Exhaust Airflow Measurement Device.**
 - ✦ A flowmeter that meets the applicable instrument accuracy shall be used to measure the mechanical supply and exhaust airflow.



Tools Used

✦ **Powered Flow Capture Hood Airflow Measurement Device.**

- ✦ A powered and pressure balanced flow capture hood.
 - Has the capability to balance the flow capture static pressure difference between the room and the flow capture hood enclosure
 - May be used to verify the ventilation airflow rate if the powered flow hood has a flow capture area at least as large as the ventilation system register/grille in all dimensions.



Tools Used

✦ **Traditional Flow Capture Hood.**

- ✦ A traditional (non-powered) flow capture hood may be used to verify the exhaust ventilation system airflow rate if:
 - The non-powered flow hood has a capture area at least as large as the ventilation system register/grille in all dimensions.
 - The flow being measured is within the flow hood's accuracy range.



Forms: IAQ Ventilation

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

CF1R-NCB or
CF1R-PRF

CF2R-MCH-01-E
and
CF2R-MCH-27-H

CF3R-MCH-27-H

Compliance Form

CF1R-PRF-01-E

Document Type

Certificates of...

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

Primary user

E = Enforcement agency
H = HERS

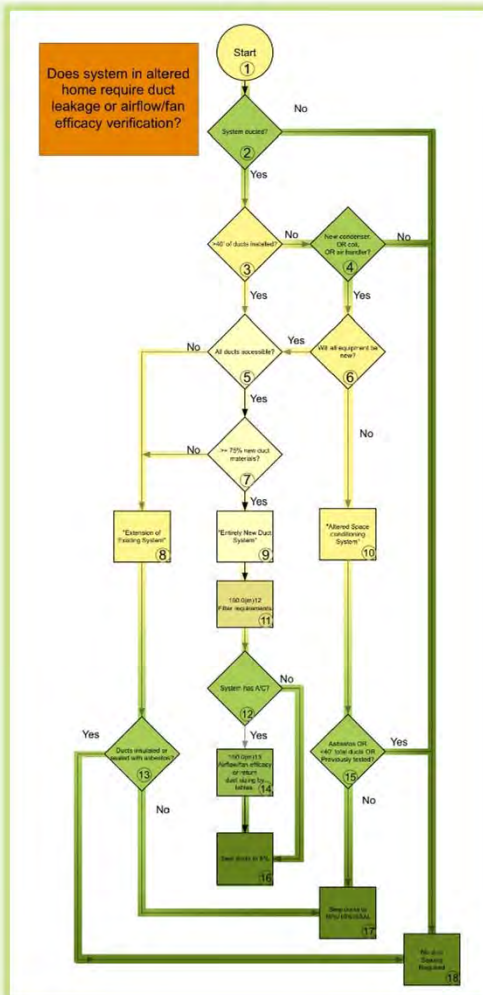


Duct Testing

Duct Testing

★ Section 150.0(m)11

- ✦ New systems > 10 ft. ducting
- ✦ Altered systems with >25 ft. ducting



| Diagnostic | Description | Procedure |
|---------------------|---|-----------|
| Duct Leakage | Verify that duct leakage is less than or equal to the compliance criteria given in Table RA3.1-2. | RA3.1.4.3 |



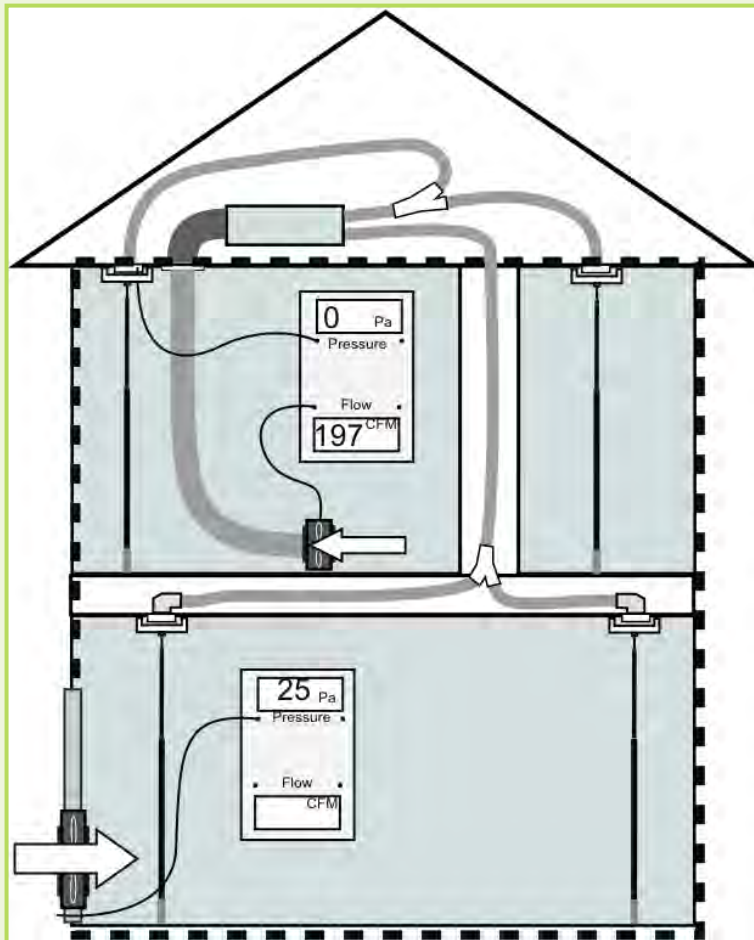
Duct Testing: Table RA3.1-2

| Case | User Application | Leakage Compliance Criteria (% of Air Handler Airflow) | Procedure(s) |
|--|--|---|---|
| Sealed and tested new duct systems in single family homes and townhomes | Installer Testing at Final HERS Rater Testing | 6% | RA3.1.4.3.1 |
| | Installer Testing at Rough-in, Air Handling Unit Installed | 6% Installer Inspection at Final | RA3.1.4.3.2 RA3.1.4.3.2.1 RA3.1.4.3.3 |
| | Installer Testing at Rough-in, Air Handling Unit Not Installed | 4% Installer Inspection at Final | RA3.1.4.3.2 RA3.1.4.3.2.2 RA3.1.4.3.3 |
| Sealed and tested new duct systems in multi-family homes regardless of duct system location. | Installer Testing at Final HERS Rater Testing | 12% Total Duct Leakage | RA3.1.4.3.1 |
| | | 6% Leakage to Outside | RA3.1.4.3.4 |
| Sealed and tested altered existing duct systems | Installer Testing HERS Rater Testing | 15% Total Duct Leakage | RA3.1.4.3.1 |
| | | 10% Leakage to Outside | RA3.1.4.3.4 |
| | Installer Testing and Inspection HERS Rater Testing and Verification | Fails Leakage Tests but All Accessible Ducts are Sealed. Inspection and Smoke Test with 100% Verification | RA3.1.4.3.5 RA3.1.4.3.6 RA3.1.4.3.7 |



Tools Used

- ✦ **Apparatus for Duct Pressurization and Leakage Flow Measurement.**
 - ✦ The apparatus for fan pressurization duct leakage measurements shall consist of a duct pressurization and flow measurement device.



Tools Used

✦ Apparatus for Duct Leakage to Outside Measurement.

- ✦ The apparatus for measuring duct leakage to outside shall include a fan that is capable of maintaining the pressure within the conditioned spaces in the house at 25 Pa (0.1 inches water) relative to the outdoors.
- ✦ The fan most commonly used for this purpose is known as a "blower door" and is typically installed within a temporary seal of an open exterior doorway.



Tools Used

- ✦ **Apparatus for Smoke-Test of Accessible-Duct Sealing (Existing Duct Systems).**
 - ✦ The apparatus for determining leakage in and verifying sealing of all accessible leaks in existing duct systems provide means for introducing controllable amounts of *non-toxic visual/theatrical smoke* into the duct pressurization apparatus for identifying leaks in accessible portions of the duct system.
 - ✦ The means for generating smoke shall have sufficient capacity to ensure that any accessible leaks will emit visibly identifiable smoke.



Forms: Duct Testing

CF1R-NCB or
CF1R-PRF or
CF1R-ADD or
CF1R-ALT

CF2R-MCH-01-E
and
CF2R-MCH-20-H

CF3R-MCH-20-H

Compliance Form

Document Category

PRF = Performance approach
NCB = New construction & additions > 1,000 ft²
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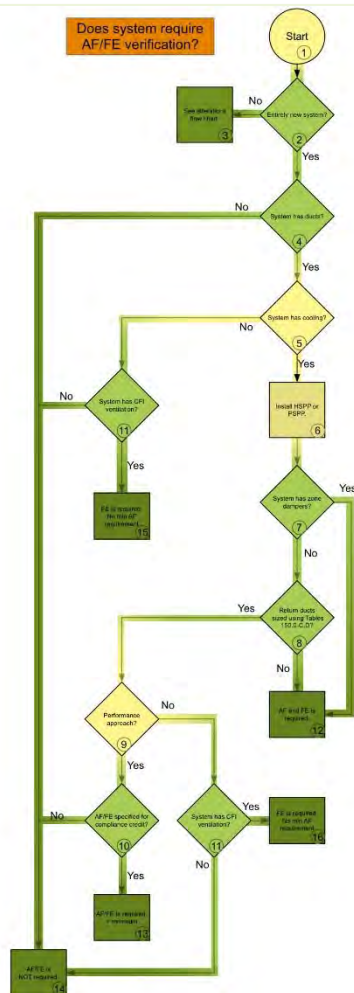


Mandatory HERS Measures

Airflow / Fan Watt Draw

◆ Section 150.0(m)13

- ◆ New ducted systems with AC
- ◆ Entirely new ducted systems with AC



| Diagnostic | Description | Procedure |
|--|--|----------------|
| Forced Air System Airflow Rate, Fan Watt Draw, and Determination of Fan Efficacy. | <p>(a) Verification of improved system airflow rate (cfm) in ducted split system and packaged space conditioning systems serving low-rise residential buildings.</p> <p>(b) Verification of reduced fan power (Watt) draw achieved through improved air distribution system design, including more efficient motors and ducts that have less resistance to airflow.</p> <p>(c) Determination of fan efficacy (Watt/cfm) utilizing simultaneous measurement of system Watt draw and airflow rate.</p> <p><i>Exception: Size the return ducts per Table 150.0-C or 150.0-D</i></p> | RA3.3.3 |



What's Tested

✦ Airflow Measurements

- ✦ Provide airflow through the return grilles that is equal to or greater than 350 CFM per ton of nominal cooling capacity.
- ✦ At the same time the fan watt draw must be less than or equal to 0.58 Watts per CFM.



Flow Grid

Tools Used

✦ Airflow Rate Methods

- ✦ Active or passive flow capture hood to measure the total airflow through the return grill(s), or
- ✦ *Flow grid device(s) at the return grill(s) or other location where all the central fan airflow passes through the flow grid, or*
- ✦ Fan flow meter device to perform the plenum pressure matching procedure.



Two plug-in watt meters and a clamp-on watt meter

Tools Used

✦ Fan Watt Draw Measurements

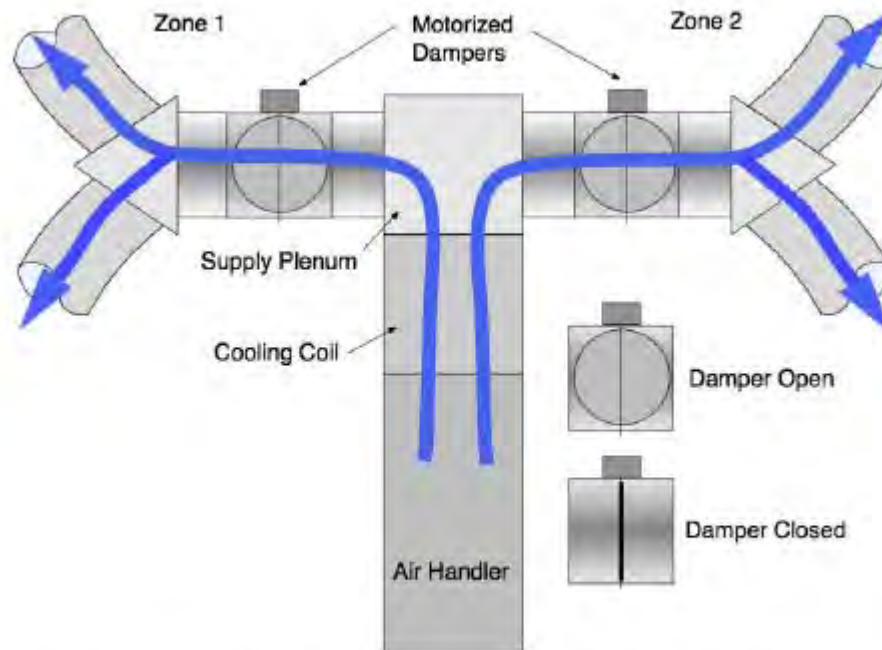
- ✦ *A portable watt meter (clamp-on vs plug-in),*
- ✦ An analog utility revenue meter, or
- ✦ A digital utility revenue meter.



Zonally Controlled Central FAU

Zonally Controlled Central FAU

- ◆ Section 150.0(m)15
- ◆ New central forced AC systems



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

Single-Zone Ducted Cooling Systems (Single Zone Off of a Single Air Handler)

| Compressor Type | Mandatory Requirements for Airflow and Fan Efficacy ¹ | Performance Compliance Option ² | |
|---|---|--|---|
| | | Proposed House Defaults ³ | Modeled Improved Airflow and/or Fan Efficacy |
| <p>Single Speed and Two Speed or Variable Speed</p> <p>(Testing Performed on Highest Speed only)</p> | <p>Airflow \geq 350 CFM/ton, and Fan Efficacy \leq 0.58 W/CFM</p> <p>(Airflow and Fan Efficacy testing not required if Return System Sized to Tables 150.0- C or D, but verification of sizing is required)</p> | <p>350 CFM/ton and 0.58 W/CFM</p> | <p>Airflow \geq 350 CFM/ton and/or Fan Efficacy \leq 0.58 W/CFM</p> |

Zoned Ducted Cooling Systems (Multiple Zones Off of a Single Air Handler)

| | | | |
|---|--|---|--|
| <p>Single Speed</p> | <p>Airflow \geq 350 CFM/ton and Fan Efficacy \leq 0.58 W/CFM</p> <p>(For Prescriptive Compliance Method, verification is mandatory in all zonal control modes. For Performance Compliance Method, verification is mandatory using highest capacity with all zones calling)</p> | <p>150 CFM/ton and 0.58 W/CFM</p> | <p>Airflow \geq 150 CFM/ton and/or Fan Efficacy \leq 0.58 W/CFM</p> <p>(Verification of better-than default values required in all zonal control modes. Mandatory requirement of 350 CFM/ton and 0.58 W/CFM still applies for all zones calling)</p> |
| <p>Two Speed or Variable Speed</p> | <p>Airflow \geq 350 CFM/ton and Fan Efficacy \leq 0.58 W/CFM</p> <p>(Verification Required Only on Highest Capacity and with All Zones Calling)</p> | <p>350 CFM/ton and 0.58 W/CFM</p> | <p>Airflow \geq 350 CFM/ton and/or Fan Efficacy \leq 0.58 W/CFM</p> <p>(Verification of modeled improved values required only on Highest Capacity and with All Zones Calling)</p> |

1 For the Prescriptive Compliance Method, all Mandatory Requirements for airflow and fan efficacy must be met, and use of a bypass duct is not allowed.

2 For the Performance Compliance Method, all Mandatory Requirements for airflow and fan efficacy must be met, and use of a bypass duct may be specified in the compliance software input for the zoned system type.

3 The Standard House Defaults for all cases are 350 CFM/ton and 0.58 W/CFM.



Forms: Air Flow/Fan Watt Draw

CF1R-NCB or
CF1R-PRF or
CF1R-ADD or
CF1R-ALT

CF2R-MCH-01-E
and
CF2R-MCH-22-H
CF2R-MCH-23-H
or
CF2R-MCH-28-H
(Return Duct and
Filter Grille Design
Table 150.0)

CF3R-MCH-22-H
CF3R-MCH-23-H
or
CF3R-MCH-28-H

Document Category

PRF = Performance approach
NCB = New construction &
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CF1R-PRF-01-E

Document Type

Certificates of...

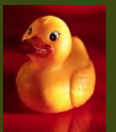
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2R = Installation
3R = HERS Verification

Primary user

E = Enforcement agency
H = HERS



Check your understanding





Let's Talk Challenge A

Drag the picture to the appropriate testing procedure.

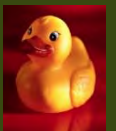


Drag the picture to the appropriate testing procedure.

- a) Duct pressurization and flow measurement testing
- b) Traditional Flow Capture Hood
- c) Flow grid device at the return grill

What is *BEING* tested?

- a) Duct leakage
- b) IAQ ventilation
- c) Return air flow rate





Challenge B



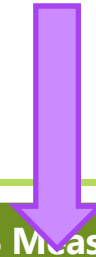
Challenge B



Residential
Prescriptive/Performance
HERS Measures



HERS Measures



| 2013 Residential HERS Measures | | | | |
|--|-------------|---------------------------|---------------|------------------------|
| Measure | Mandatory | Prescriptive | Performance | Reference Appendices # |
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| Indoor air quality ventilation (consistent with ASHRAE Standard 62.2) | §150.0(o) | | | 3.7 |
| Refrigerant charge or Installation of a charge indicator display (CID) | | CZ 2, 8-15 §150.1(c)7A | CZ 1, 3-7, 16 | 1.2, 3.2 |
| Duct design (reduced surface area, high insulation, and duct location) | | | X | 3.1 |
| Ducts entirely in conditioned space | | §150.1(c)9 | X | 3.1 |
| Low leakage ducts entirely in conditioned space | | | X | 3.1 |
| Ducts <12 feet outside conditioned space | | | X | 3.1 |
| Low leakage air handlers | | | X | 3.1 |
| Cooling coil air flow and air handler fan watt draw OR Verified return duct design and air filter device | §150.0(m)13 | | | 3.1, 3.3 |
| High SEER and/or High EER | | | §150.1(b)4B | 3.4 |
| Photovoltaic (PV) system capacity to qualify for PV rebate via New Solar Home Partnership | | | X | 4.6 |
| Central fan integrated ventilation cooling systems | | §150.1(C)10 | | 3.3 |
| Zonal control for compliance credit | | | X | 3.3 |
| Evaporatively cooled condensers | | | X | 3.1, 3.2, 3.4 |
| Ice storage air conditioners | | | X | 4.3 |
| Envelope | | | | |
| Quality insulation installation (QII) | | | X | 3.5 |
| Building envelope sealing | | | X | 3.8 |
| Plumbing | | | | |
| Pipe insulation | | | X | 3.6 |
| Verified design (parallel piping, compact design, point of use) | | | X | 3.6 |
| Multi Family recirculation loops | | | X | 3.6 |



Prescriptive HERS Measures

Refrigerant Charge

- ✦ Section 150.1(c)7A
 - ✦ New systems with AC in CZ 2, 8-15
 - ✦ Altered AC in CZ 2, 8-15

No Duct Insulation

- ✦ Section 150.1(c)9
 - ✦ New ducts not insulated because they are deemed to be in directly conditioned space

Central Fan Integrated Ventilation

- ✦ Section 150.1(c)10
 - ✦ When a central FAU is used for mechanical ventilation, fan watt draw testing is required

Bypass Ducts

- ✦ Section 150.1(c)13
 - ✦ If a zonally controlled FAU being used, bypass cannot be used using the prescriptive approach



Refrigerant Charge

continued...

| Case | User Application | Compliance Criteria | Procedure(s) |
|---|-----------------------------------|---|--------------|
| Standard Charge Verification Procedure – Fixed Metering Device Systems | Installer Testing at Final | 55°F ≤ Outdoor Air Dry-bulb Temp ≤ 115°F Return Air Dry-bulb Temp ≥ 70°F Return Air Wet-bulb Temp ≤ 76°F Superheat tolerance ±5°F of the specified target | RA3.2.2.6.1 |
| | HERS Rater Testing | 55°F ≤ Outdoor Air Dry-bulb Temp ≤ 115°F Return Air Dry-bulb Temp ≥ 70°F Return Air Wet-bulb Temp ≤ 76°F Superheat tolerance ±8°F of the specified target | RA3.2.2.6.1 |
| Standard Charge Verification Procedure – Variable Metering Device Systems | Installer Testing at Final | 55°F ≤ Outdoor Air Dry-bulb Temp ≤ 120°F Return Air Dry-bulb Temp ≥ 70°F Subcooling tolerance ±3°F of the manufacturer-specified target ¹ Metering Device tolerance: Superheat meets the Manufacturer's specifications or 4°F ≤ Superheat ≤ 25°F | RA3.2.2.6.2 |
| | HERS Rater Testing | 55°F ≤ Outdoor Air Dry-bulb Temp ≤ 120°F Return Air Dry-bulb Temp ≥ 70°F Subcooling tolerance ±6°F of the manufacturer-specified target ¹ and Subcooling ≥ 2°F Metering Device tolerance: Superheat meets the Manufacturer's specifications or 3°F ≤ Superheat ≤ 26°F | RA3.2.2.6.2 |

Note:

1. If a manufacturer-specified subcooling target value is not available or cannot be determined, the Executive Director may provide additional guidance for compliance.



What's Tested

Standard Charge (RA3.2.2)

- ✦ The procedures are applicable to ducted split system air-cooled air conditioners and ducted split system air-source heat pumps, and may be applicable to packaged air-cooled air conditioners and packaged air-source heat pumps.
- ✦ Verification of
 - minimum system airflow rate across the cooling coil.
 - metering device is operating properly.
- ✦ Outdoor air temperature is 55°F or above.
- ✦ Shall **not** use group sampling, when the alternative to compliance with minimum system airflow are utilized for compliance (*See Challenge D*).



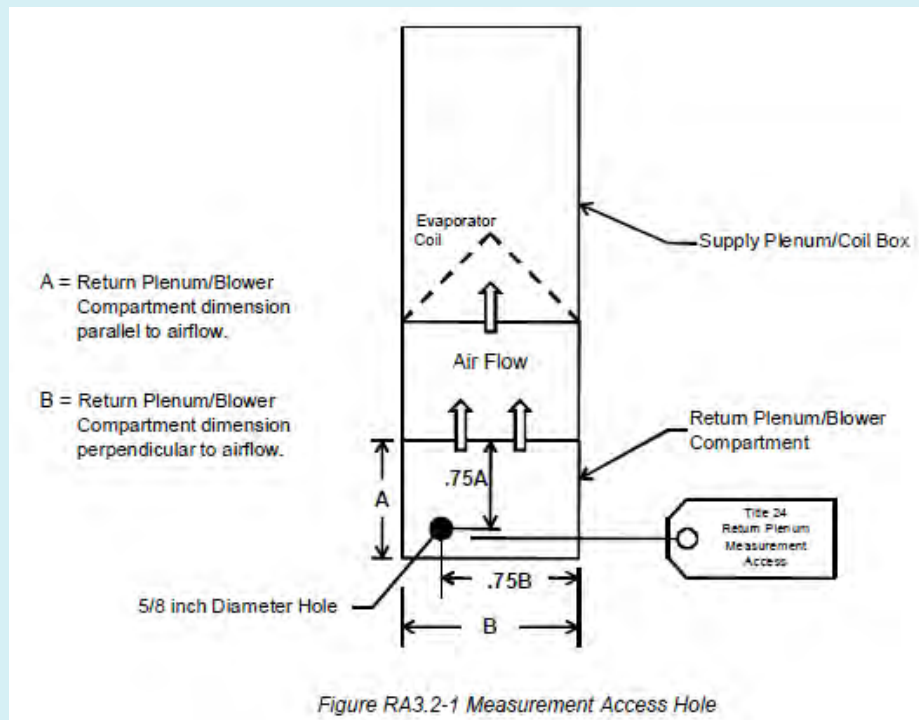
What's Tested

Measurement Access Hole (RA3.2.2.3)

- ✦ When required for compliance or when return plenum measurements are necessary for compliance with refrigerant charge verification requirements, a 5/8 inch (16 mm) diameter hole shall be provided.

✦ Exceptions:

- Return located entirely within conditioned space
- Systems that cannot conform to the specifications for the hole location shown.





What's Tested

Weigh-In Charge (RA3.2.1.2)

- ✦ The procedures are applicable to air-cooled air conditioners or air-source heat pumps.
 - ✧ at any outdoor temperature.
 - ✧ does not exempt the system from minimum airflow verification requirements
 - ✧ shall not use group sampling when utilized by the HVAC installer
- ✦ HVAC installers
 - ✧ MAY be used as an alternative to the Standard Charge
 - ✧ SHALL be used
 - when the outdoor air temperature is below 55°F
 - standard charge verification is not applicable and there is no applicable alternative special case
- ✦ HERS raters
 - ✧ SHALL observe HVAC installer test when they elect to use this method



Alternative (when available 😊)

Charge Indicator Display (RA4.3.2)

- ✦ The installation of a charge indicator display (CID) may be used as an alternative to the prescriptive requirement for HERS diagnostic testing of the refrigerant charge in split system air conditioners and heat pumps.
- ✧ Provide real-time information to the building occupant about the status of the
 - system refrigerant charge,
 - metering device, and
 - system airflow.



Forms: Refrigerant Charge

CF1R-NCB or
CF1R-PRF or
CF1R-ADD or
CF1R-ALT

CF2R-MCH-01-E
and
CF2R-MCH-25-H

CF3R-MCH-25-H

Compliance Form

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



Document Type

Certificates of...

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

Primary user

E = Enforcement agency
H = HERS



No Duct Insulation

No Duct Insulation

✦ Section 150.1(c)9

✦ New ducts not insulated because they are deemed to be in directly conditioned space



| Diagnostic | Description | Procedure(s) |
|---|---|--|
| Verified location of ducts in conditioned space with no insulation | When ducts are located in conditioned space, and not insulated. | RA3.1.4.1.3 <i>Visual inspections</i> |
| | | RA3.1.4.3.4 <i>Duct Testing</i> |



What's Tested

Low Leakage Ducts Located Entirely in Conditioned Space (RA3.1.4.3.8)

- ✦ duct leakage to outside is equal to or less than 25 cfm
- ✦ verified ducts in conditioned space by visual inspection





Forms: No Duct Insulation

CF1R-NCB or
CF1R-PRF or

CF2R-MCH-01-E
and
CF2R-MCH-20-H
CF2R-MCH-21-H

CF3R-MCH-20-H
CF3R-MCH-21-H

Compliance Form

Document Category

PRF = Performance approach
NCB = New construction & additions > 1,000 ft²
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CF1R-PRF-01-E

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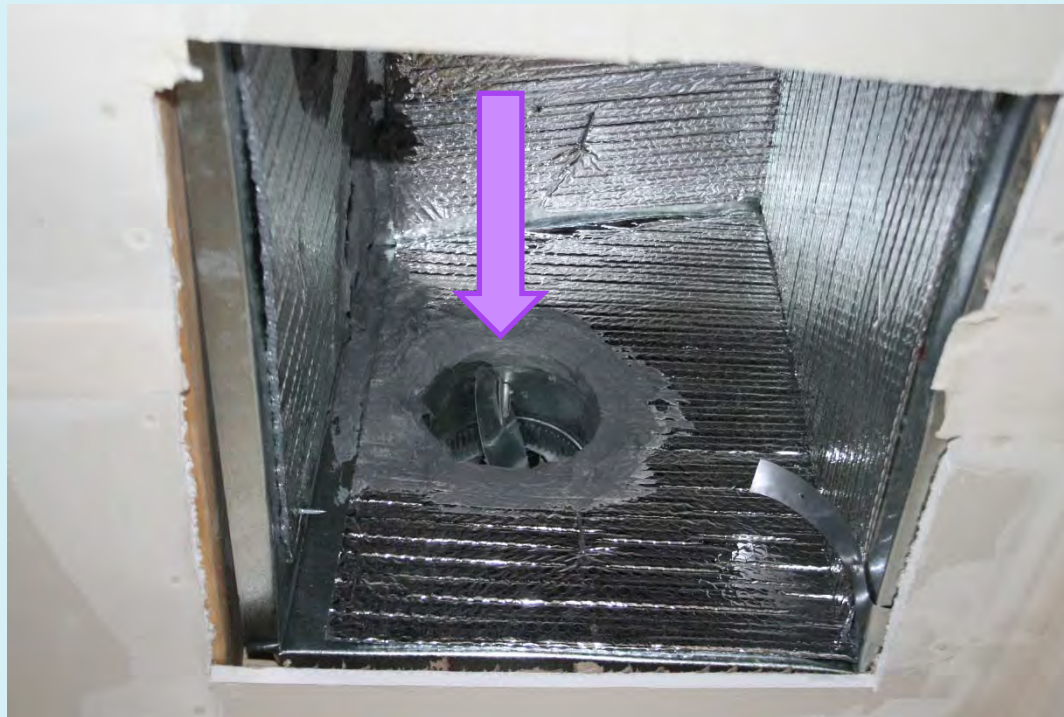


Central Fan Integrated Ventilation

Central Fan Integrated Ventilation

◆ Section 150.1(c)10

- ◆ When a central FAU is used for mechanical ventilation, fan watt draw testing is required



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



Forms: Central Fan Integrated Ventilation

CF1R-NCB or
CF1R-PRF or
CF1R-ADD or
CF1R-ALT

CF2R-MCH-01-E
and
CF2R-MCH-22-H
CF2R-MCH-23-H

CF3R-MCH-22-H
CF3R-MCH-23-H

Document Category

PRF = Performance approach

NCB = New construction &
additions > 1,000 ft²

ADD = Additions (\leq 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

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CF1R-PRF-01-E

Document Type

Certificates of...

1R = Compliance

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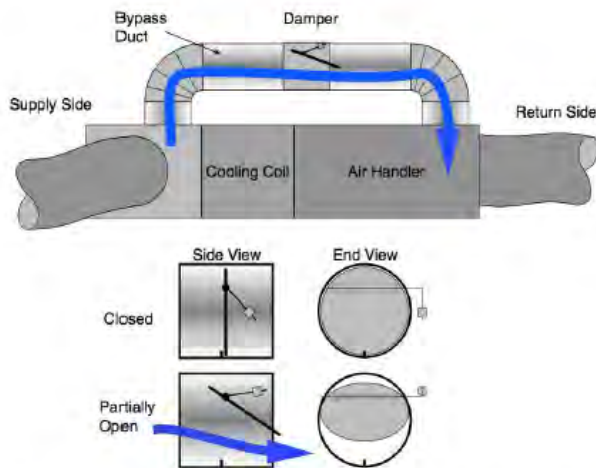


No Bypass Ducts

No Bypass Ducts

◆ Section 150.1(c)13

✦ If a zonally controlled FAU being used, bypass cannot be used using the prescriptive approach



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.

| Diagnostic | Description | Procedure(s) |
|---|---|--|
| Verified that bypass ducts not used for zonally controlled FAU systems | 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. | RA3.1.4.1.6 <i>Visual inspections</i> |



Forms: No Bypass Ducts

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

CF1R-NCB or
CF1R-PRF or
CF1R-ADD or

CF2R-MCH-01-E
and
CF2R-MCH-23-H

CF3R-MCH-23-H

Compliance Form

CF1R-PRF-01-E

Document Type

Certificates of...

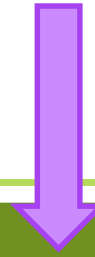
1R = Compliance
2R = Installation
3R = HERS Verification

Primary user

E = Enforcement agency
H = HERS



HERS Measures



| 2013 Residential HERS Measures | | | | |
|--|-------------|---------------------------|---------------|------------------------|
| Measure | Mandatory | Prescriptive | Performance | Reference Appendices # |
| Mechanical | | | | |
| Duct sealing (maximum leakage) | §150.0(m)11 | | | 3.1 |
| Indoor air quality ventilation (consistent with ASHRAE Standard 62.2) | §150.0(o) | | | 3.7 |
| Refrigerant charge or Installation of a charge indicator display (CID) | | CZ 2, 8-15 §150.1(c)7A | CZ 1, 3-7, 16 | 1.2, 3.2 |
| Duct design (reduced surface area, high insulation, and duct location) | | | X | 3.1 |
| Ducts entirely in conditioned space | | §150.1(c)9 | X | 3.1 |
| Low leakage ducts entirely in conditioned space | | | X | 3.1 |
| Ducts <12 feet outside conditioned space | | | X | 3.1 |
| Low leakage air handlers | | | X | 3.1 |
| Cooling coil air flow and air handler fan watt draw OR Verified return duct design and air filter device | §150.0(m)13 | | | 3.1, 3.3 |
| High SEER and/or High EER | | | §150.1(b)4B | 3.4 |
| Photovoltaic (PV) system capacity to qualify for PV rebate via New Solar Home Partnership | | | X | 4.6 |
| Central fan integrated ventilation cooling systems | | §150.1(C)10 | | 3.3 |
| Zonal control for compliance credit | | | X | 3.3 |
| Evaporatively cooled condensers | | | X | 3.1, 3.2, 3.4 |
| Ice storage air conditioners | | | X | 4.3 |
| Envelope | | | | |
| Quality insulation installation (QII) | | | X | 3.5 |
| Building envelope sealing | | | X | 3.8 |
| Plumbing | | | | |
| Pipe insulation | | | X | 3.6 |
| Verified design (parallel piping, compact design, point of use) | | | X | 3.6 |
| Multi Family recirculation loops | | | X | 3.6 |



Performance HERS Measures

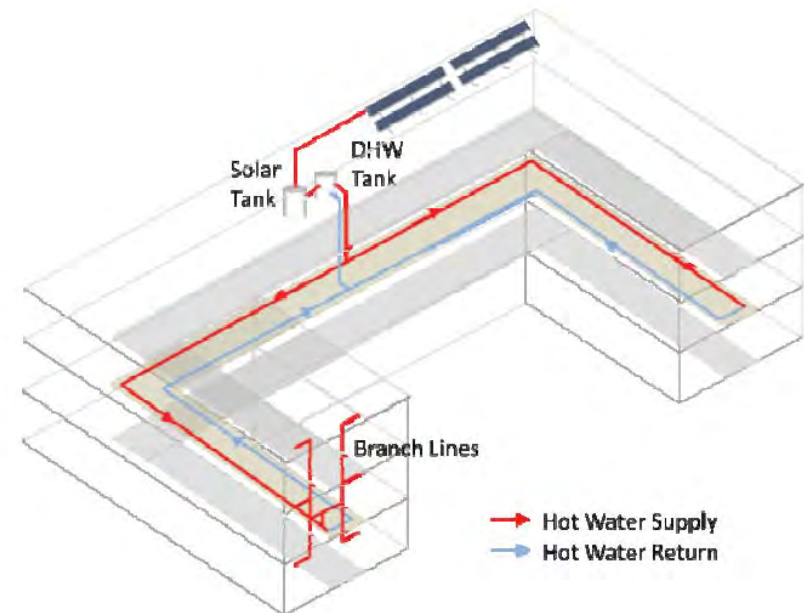


| Envelope | | | | |
|---------------------------------------|-------------------------------|----------|---|----------------------|
| Measure | RA # | Forms | | |
| Quality Insulation Installation (QII) | 3.5 | CF1R-PRF | CF2R-ENV-01/02/03-E CF2R-ENV-21/22/23/24-H | CF3R-ENV-21/22/23/24 |
| Building Envelope Sealing | 3.8 | CF1R-PRF | CF2R-ENV-01/02/03-E CF2R-ENV-20-H | CF3R-ENV-20 |
| HERS Verified Pre-Existing Conditions | Residential Manual Appendix G | CF1R-PRF | | CF3R-EXC-30 |



Performance HERS Measures

| Plumbing | | | | |
|---|------|----------|--|-------------------|
| Measure | RA # | Forms | | |
| Pipe Insulation and/or Verified Design Parallel piping Compact design Point of use | 3.6 | CF1R-PRF | CF2R-PLB-01 or 02-E CF2R-PLB-21 or 22-H | CF3R-PLB-21 or 22 |
| Multi Family Recirculation Loop | 3.6 | CF1R-PRF | CF2R-PLB-02-E CF2R-PLB-21-H | CF3R-PLB-21 |





Performance HERS Measures

HVAC

| <i>Measure</i> | <i>RA #</i> | <i>Forms</i> | | |
|---|--|--------------|--|-------------------|
| Refrigerant Charge in CZ 1, 3-7 and 16 | 3.2 | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-25-H | CF3R-MCH-25-H |
| Duct Design Reduced surface area High insulation Duct location | 3.1.4 | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-29-H | CF3R-MCH-29-H |
| Ducts Entirely In Conditioned | 3.1.4.3.8 | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-20/21-H | CF3R-MCH-20/21 |
| Low Leakage Ducts In Conditioned Space | 3.1.4.3.9 | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-20/21-H | CF3R-MCH-20/21 |
| Ducts <12 ft Outside Conditioned Space | 3.1.4.1.2 | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-20/21-H | CF3R-MCH-20/21 |
| Cooling coil air flow and air handler fan watt draw AND/OR Verified return duct design and air | 3.1 / 3.3 | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-20/21 | CF3R-MCH-20/21 |
| High SEER / High EER | 3.4 | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-26-H | CF3R-MCH-26-H |
| Zonal control for performance credit | 3.3 and Residential Manual Appendix F | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-22/23-H | CF3R-MCH-22/23 |
| Evaporatively cooled condensers | 3.1, 3.2, 3.4 | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-20/25/26-H | CF3R-MCH-20/25/26 |
| Ice storage air conditioners | 4.3 | CF1R-PRF | CF2R-MCH-01-E and CF2R-MCH-20/25/26-H | CF3R-MCH-20/25/26 |



Performance: Forms

CF1R-PRF-01-E

CERTIFICATE OF COMPLIANCE - RESIDENTIAL PERFORMANCE COMPLIANCE METHOD

CF1R-PRF-01

Project Name: Zonal Control Example

Calculation Date/Time: 18:38, Sun, Sep 14, 2014

Page 1 of 8

Calculation Description: Title 24 Analysis

Input File Name: Res Zonal Example.xml

| GENERAL INFORMATION | | | | | |
|---------------------|---|-----------------------|----|----------------------------------|------------------------|
| 01 | Project Name | Zonal Control Example | | | |
| 02 | Calculation Description | Title 24 Analysis | | | |
| 03 | Project Location | 7188 Pleasant Way | | | |
| 04 | A City | Sacramento | 05 | Standards Version | Compliance 2015 |
| 06 | Zip code | 90000 | 07 | Compliance Manager Version | BEMcmpMgr 2013-3 (650) |
| 08 | Climate Zone | CZ10 | 09 | Software Version | EnergyPro 6.3 |
| 10 | Building Type | Single Family | 11 | Front Orientation (deg/Cardinal) | 90 |
| 12 | Project Scope | Newly Constructed | 13 | Number of Dwelling Units | 1 |
| 14 | Total Cond. Floor Area (FT ²) | 2000 | 15 | Number of Zones | 2 |
| 16 | Slab Area (FT ²) | 600 | 17 | Number of Stories | 3 |
| 18 | Addition Cond. Floor Area | NA | 19 | Natural Gas Available | Yes |
| 20 | Addition Slab Area (FT ²) | NA | 21 | Glazing Percentage (%) | 19.5% |

| COMPLIANCE RESULTS | |
|--------------------|---|
| 01 | Building Complies with Computer Performance |
| 02 | This building incorporates features that require field testing and/or verification by a certified HERS rater under the supervision of a CEC-approved HERS provider. |
| 03 | This building incorporates one or more Special Features shown below |

| ENERGY USE SUMMARY | | | | |
|-------------------------|-----------------|-----------------|-------------------|---------------------|
| 04 | 05 | 06 | 07 | 08 |
| Energy Use (kTDO/ft) | Standard Design | Proposed Design | Compliance Margin | Percent Improvement |
| Space Heating | 7.93 | 4.95 | 2.98 | 37.6% |
| Space Cooling | 35.71 | 37.50 | -1.79 | -5.0% |
| IAQ Ventilation | 1.62 | 1.62 | 0.00 | 0.0% |
| Water Heating | 13.38 | 8.94 | 4.44 | 33.2% |
| Photovoltaic Offset | --- | -5.36 | 5.36 | --- |
| Compliance Energy Total | 58.64 | 47.65 | 10.99 | 18.7% |

Registration Number:

CA Building Energy Efficiency Standards - 2013 Residential Compliance

Registration Date/Time:

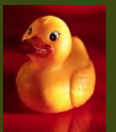
Report Version - CF1R-09042014-650

HERS Provider:

Report Generated at: 2014-09-14 18:39:06



Check your understanding





Does it HAVE to?

Let's Talk Challenge B

Ace Resources Title 24 Part 6 Residential Triggers Sheet

HVAC Alterations

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

NOTE:

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

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

EnergyCode Ace 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. DOCUMENT ID: 147281

Refrigerant charge is required for all AC changeouts in CZ 1.

- a) Yes
- b) No**
- c) Only if "Entirely New" system

Duct testing is required if performance method used to show compliance for new home with ducted HVAC system.

- a) Yes**
- b) No
- c) Only if "Entirely New" system

HERS verified airflow and fan watt draw is always required for all altered HVAC systems.

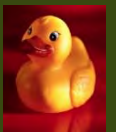
- a) Yes
- b) No
- c) Only if "Entirely New" system**





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Breath





Challenge C



Challenge C



Nonresidential
Prescriptive/Performance
HERS Measures



HERS Measures - Nonresidential

| 2013 Nonresidential HERS Measures | | | | |
|--|-----------|--------------|---------------------------|------------------------|
| Measure | Mandatory | Prescriptive | Performance | Reference Appendices # |
| Mechanical | | | | |
| Duct sealing (maximum leakage) | | §140.4(l) | | 3.1 |
| Low leakage air handlers | | | §110.2(f) X | 3.1 |
| Plumbing | | | | |
| Multi Family/Hotel & Motel recirculation systems (piping and controls) | | | X | 4.4 |
| Multi Family/Hotel & Motel pipe insulation | | | X | 4.4 |



Duct Testing

Duct Testing

✦ Section 140.4(I) / 141.0(b)E

- ✦ New systems
- ✦ Altered systems (leakage to outside not allowed)



ergy, LLC

| Diagnostic | Description | Procedure |
|--|---|-----------|
| Duct Leakage: <ul style="list-style-type: none">• <i>Constant volume, single zone system</i>• <i>Serves <5,000 ft²</i>• <i>More than 25% of the ducts outside the conditioned space</i> | Verify that duct leakage is less than or equal to the compliance criteria given in Table RA3.1-2. | RA3.1.4.3 |



Simple System HVAC Trigger Sheet

Small Commercial HVAC Alterations

Packaged Units — Single-zone, Constant Air Volume (CAV) — and Split Systems

| Change this (and nothing else) | Mandatory Measures | | | | | | | | Prescriptive Requirements | | | | | |
|--|---|---|--------------------------------------|--------------------------------------|--|---|---------------------------|---|---------------------------------|---------------------------------|---|-------------------------------------|---|---|
| | Tstat §110.2(c) §120.2(a), (b), (c) & (e) | Supply & Exhaust Dampers (ventilation provided by HVAC) §120.2(f) | Min. Cooling Efficiency §110.2(a) | Min. Heating Efficiency §110.2(a) | Ventilation Calcs (NRCC-MCH-03-E) §120.1 | Demand Control Ventilation ^A §120.1(c) 3 & 4 | Duct Insulation §120.4 | Demand Shed Controls ^B §120.2 | Cooling Load Calcs §140.4(b) | Heating Load Calcs §140.4(b) | Equipment Sizing (per load calcs) §140.4(a) | Fan Power ^C §140.4(c) | Econo- mizer ^D §140.4(e) | Duct Seal & Test ^E §140.4(l), 140.9(b)2E |
| Whole Pkg Unit Or split system NO DUCTS | YES | YES | YES | YES | YES | YES ^A | NO | YES ^B | YES | YES | YES | YES ^C | YES ^D | YES ^E |
| Cooling Coil of Packaged System | YES | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES ^E |
| Split System, Outdoor Unit | YES | NO | YES | YES ^F | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES |
| Split System, Indoor Unit | YES | NO | YES | YES ^F | NO | NO | NO | NO | NO | NO | YES | NO | NO | YES |
| Some ducts | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO | NO | NO | NO | YES ^E |
| ≥75% ducts | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO | NO | NO | NO | YES ^E |
| ≥75% new ducts and Whole Pkg Unit and Split System | YES | YES | YES | YES | YES | YES ^A | YES | YES ^B | YES | YES | YES | YES ^C | YES ^D | YES ^E |

NOTE: + For Nonresidential HVAC systems, a change in blower motor, compressor, condenser coil, or plenum is considered a repair and does not trigger the Title 24, Part 6 Standards.

- ^A If system is single-zone with any controls or multi-zone with direct digital control, and has airside economizer, and serves a high-density space (≥25 people per 1,000 ft²)
- ^B Only required if the altered unit has direct digital controls (DDC) to the zone level.
- ^C If total system fan power is >25 hp
- ^D If >54,000 Btu/h cooling capacity (4.5 tons)
- ^E If CAV single-zone system and serves <5,000 ft conditioned floor area and >25% duct surface in unconditioned space including under a roof that does not meet current prescriptive-insulation requirements.
- ^F If split system operates as a heat pump, heating efficiency must meet mandatory requirements in §110.2.



Forms: Duct Testing

NRCC-PRF or
NRCC-MCH

NRCI-MCH-01-E

NRCA-MCH-04-H

NRCV-MCH-04-H

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



HW Recirculation

HW Recirculation

- ◆ Multi family/Hotel & Motel pipe insulation
- ◆ Multi family/Hotel & Motel loops

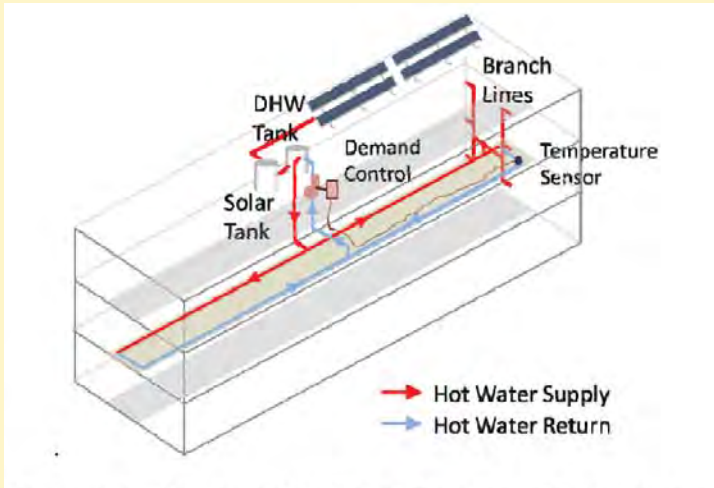


Figure 5-7 – Standard Multi-Family Central Distribution System

| Diagnostic | Description | Procedure |
|--------------------------------------|---|-----------|
| Pipe Insulation | The visual inspection: Increasing recirculation pipe insulation by 0.5 inch above the mandatory requirements | RA4.4.14 |
| Temperature Controls | Visual inspection: recirculation temperature modulation control shall reduce the hot water supply temperature one demand is met | RA4.4.11 |
| Continuous Monitoring Systems | Visual inspection: recirculation continuous monitoring systems for domestic hot water systems shall record hourly measurements; hot water supply temperatures; hot water return temperatures; status of gas valve relays of water heating equipment | RA4.4.12 |
| Demand Recirculation | Visual inspection: demand controlled recirculation systems shall operate "on-demand" | RA4.4.13 |
| Multiple Loops | Visual inspection: central DHW systems serving a building with more than eight dwelling units shall have at least two recirculation loops, each serving roughly the same number of dwelling units. | RA4.4.20 |



Forms: HW Recirculation

NRCC-PRF only!

NRCI-PLB-21-E
NRCI-PLB-22-E

NRCV-PLB-21-H
NRCV-PLB-22-H

Document Category

PRF = Performance approach

CXR = Commissioning

ELC = Electrical

ENV = Envelope

LTI = Indoor Lighting

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NR CC - PRF - 01 - E

Document Type

Certificates of...

CC = Compliance

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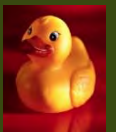
H = HERS Rater

F = Field Technician
(Contractor)

A = Acceptance Test Tech



Check your understanding





Does it HAVE to?

Let's Talk Challenge C

Ace Resources Title 24 Part 6 Nonresidential Triggers Sheet **Small Commercial HVAC Alterations**

Packaged Units — Single-zone, Constant Air Volume (CAV) — and Split Systems

| | Mandatory Measures | | | | | | | | | | Prescriptive Requirements | | | | |
|---|---------------------------------------|---|---|---|--|--|--|--|---|---|--|---|---|---|--|
| | Total (\$120.2(a)) (\$120.2(b)) | Supply & Exhaust Dampers (ventilation provided by HVAC) (\$120.2(f)) | Min. Cooling Efficiency (\$110.2(a)) | Min. Heating Efficiency (\$110.2(a)) | Ventilation Rates (NRCC- MCH-03.5) (\$120.1) | Demand Control Ventilation ^a (\$120.1)(c) 3.3.4 | Duct Insulation ^b (\$120.4) | Demand Shed Controls ^c (\$120.2) | Cooling Load Calcs ^d (\$140.4(b)) | Heating Load Calcs ^d (\$140.4(b)) | Equipment Sizing (per load calcs) (\$140.4(c)) | Fan Power ^e (\$140.4(c)) | Economizer ^f (\$140.4(e)) | Duct Seal & Test ^g (\$140.5)(2)(E) | |
| Change this (and nothing else) | | | | | | | | | | | | | | | |
| Whole Pkg Unit Or split system: NO DUCTS | YES | YES | YES | YES | YES | YES | NO | YES ^h | YES | YES | YES | YES | YES | YES ⁱ | |
| Cooling Coil of Packaged System | YES | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES ^j | |
| Split System Outdoor Unit | YES | NO | YES | YES ^k | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES | |
| Split System, Indoor Unit | YES | NO | YES | YES ^l | NO | NO | NO | NO | NO | NO | YES | NO | NO | YES | |
| Some ducts | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO | NO | NO | NO | YES ^m | |
| >75% ducts | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO | NO | NO | NO | YES ⁿ | |
| >75% new ducts and Whole Pkg Unit and Split System | YES | YES | YES | YES | YES | YES | YES | YES ^o | YES | YES | YES | YES | YES | YES ^p | |

NOTE: + For Nonresidential HVAC systems, a change in blower motor, compressor, condenser coil, or plenum is considered a repair and does not trigger the Title 24, Part 6 Standards.

^a If system is single-zone with any controls or multi-zones with direct digital control, unit has outdoor economizer, and serves a high-density space (50% occupant per 1,000 ft²)
^b Only required if the altered unit has direct digital controls (DDC) to the zone level
^c If total system fan power is >25 hp
^d If >54,000 Btu/h cooling capacity (4.5 tons)
^e If CAV single-zone system and serves >5,000 ft² conditioned floor area and >25% duct surface in unconditioned space including under a roof that does not meet current prescriptive insulation requirements
^f If split system operates as a heat pump, heating efficiency must meet mandatory requirements in §110.2

EnergyCodeAce
 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

When do the ducts need to be HERS tested?

- a) Constant volume system
- b) Serves <5,000 ft² as one zone
- c) >25% ducting outside conditioned space
- d) When all of the above are triggered

Duct testing is not required when...

- a) The performance method shows it is not required
- b) If a VAV system is being used
- c) The space is >5,000 ft²
- d) All of the above

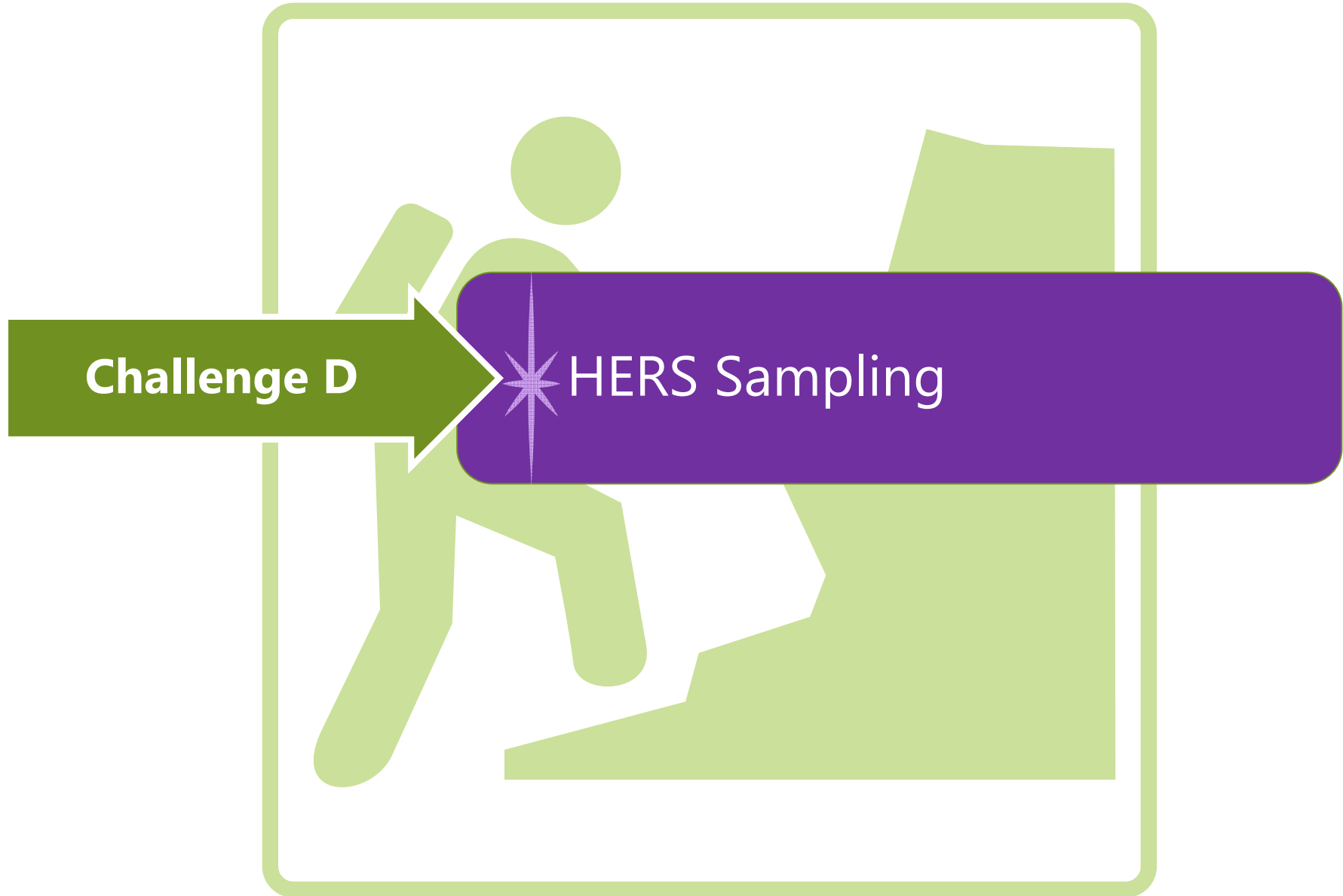


HERS verification of multi family hot water distribution is required when:

- a) The space is >5,000 ft²
- b) The performance method shows it is required
- c) >25% piping outside conditioned space
- d) The prescriptive method is used



Challenge D





Sampling – General Concepts

- ✦ Sampling is a means by which multiple homes can be passed as a “group” by having the rater just test one home.
- ✦ This may be more cost effective than having the rater test every house, especially in new construction subdivisions.





HERS Sampling

New Construction

- ✦ Sampling only applies to subdivisions.
- ✦ Open Group or Closed Group Sampling
- ✦ Must Test "Models" first

Alterations

- ✦ Houses (dwelling units) are sampled as a single unit regardless of how many HVAC systems need to be tested.
- ✦ Closed Group Sampling Only

Re-Sampling (fail)

- ✦ Closed Group: Entire group is ready for sampling before first house is selected.
- ✦ Open Group: Houses can be added to group after first house is selected.

Not Allowed

- ✦ Sampling is not always allowed, dependent upon the situation.
- ✦ Some HERS measures can never be sampled.



New Construction - Subdivisions

(RA 2.6) New Subdivisions

- ✦ Sampling only applies to subdivisions.
- ✦ Open Group or Closed Group Sampling
- ✦ Must Test "Models" first





New Construction



Groups (RA 2.6.3.2)

Closed

Up to **seven homes** can be put into a sample group.

- Each measure to be tested must be finished, tested by the installer, and certified prior to the rater performing their test (except measures that are verified in stages – e.g., QII).
- The group is “closed” prior to the testing and no more homes can be added.

Open

Can be started with a single home ready for testing.

- The group can be left “open” for up to six months.
 - **maximum of five homes** are in the group
 - one home in the group is tested and passed, all other homes are assumed to pass until **6 months** passes



New Construction: Process (RA2.6.3)



| Groups | Selection | Failing |
|---|--|---|
| <p>Homes are put into groups.</p> <ul style="list-style-type: none">• One house from the group is selected and tested by the rater.• If it passes, they all pass. | <p>HERS rater must randomly pick a home from the group to sample.</p> <ul style="list-style-type: none">• Installer cannot know which house will be tested | <p>If the first unit tested in the group fails, it must</p> <ul style="list-style-type: none">• be recorded in the registry• be corrected and re-tested until it passes |
| <p>Every home must first be tested and certified by the installer</p> <ul style="list-style-type: none">• CF2R signed and registered to be put into a group. | <p>For houses to be in a group together, they must all have the same set of HERS measures.</p> <ul style="list-style-type: none">• Different measures can be tested on different homes. | <p>Other measures are not affected by failed measure.</p> <ul style="list-style-type: none">• "Re-sampling" for the failed measure must then occur on all homes in the group |



Registered "Sample" CF3R

| | |
|-----------------------------|---------------|
| CERTIFICATE OF VERIFICATION | CF3R-MCH-20-H |
| | (Page 1 of 1) |

| | | |
|---|--|---|
| Project Name | HERS Provider Data Registry Information | |
| Dwelling Address | Sample Group Number (if applicable): 214-00110 | Dwelling Test Status in Sample Group (if applicable) NotTested |
| HERS meas This measu on this Cer | HERS Rater Information | |
| Document: | HERS Rater Company Name: John Rater's HVAC | |
| 1. I certify | Responsible Rater Name: John Rater | Responsible Rater Signature: <i>John Rater</i> |
| Documentation John Rater Company: John Address: 1234 A Stree City/State/Zip: F | Responsible Rater Certification Number w/ this HERS Provider: USR999999 | Date Signed: 2014-09-23 09:56:52 |

Digitally signed by CalCERTS. This digital signature is provided in order to secure the content of this registered document, and in no way implies Registration Provider responsibility for the accuracy of the information.

- Responsible
- I certify the foll
1. The
 2. I ar
 3. The
 4. The
 5. I w

Registration Number: 214-A0097203A-M2000003A-M20A Registration Date/Time: 2014-09-23 09:56:52 HERS Provider: CalCERTS

CA Building Energy Efficiency Standards Report Version: 2014-05-08 Report Generated: 2014-09-23 10:56:13

2013 Residential Compliance Schema Version:

| | | |
|------------|---|---|
| Builder Or | Company Name (Installing Subcontractor, General Contractor, or Builder/Owner): DEV INSTALLERS & | |
| | Responsible Builder or Installer Name: DEV INSTALLERS & | CSLB License: 137345 |
| | HERS Provider Data Registry Information | |
| | Sample Group Number (if applicable): 214-00110 | Dwelling Test Status in Sample Group (if applicable) NotTested |
| | HERS Rater Information | |
| | HERS Rater Company Name: John Rater's HVAC | |
| | Responsible Rater Name: John Rater | Responsible Rater Signature: <i>John Rater</i> |
| | Responsible Rater Certification Number w/ this HERS Provider: USR999999 | Date Signed: 2014-09-23 09:56:52 |

Digitally signed by CalCERTS. This digital signature is provided in order to secure the content of this registered document, and in no way implies Registration Provider responsibility for the accuracy of the information.

Registration Number: 214-A0097203A-M2000003A-M20A Registration Date/Time: 2014-09-23 09:56:52 HERS Provider: CalCERTS

CA Building Energy Efficiency Standards Report Version: 2014-05-08 Report Generated: 2014-09-23 10:56:13

2013 Residential Compliance Schema Version:



Alterations

(RA 2.8)
Alterations

- ✦ Houses (dwelling units) are sampled as a single unit regardless of how many systems need to be tested.
 - ✦ Closed Group Sampling Only



Houses in a group do not have to be in the same jurisdiction.

- *Building departments could require they **are** all in their jurisdiction;*
- *or require additional testing of a house from a group that **is in** their jurisdiction.*



Re-Sampling: What if it fails?

Re-Sampling (fail)

- ✦ Closed Group: Entire group is ready for sampling before first house is selected.
- ✦ Open Group: Houses can be added to group after first house is selected.

| Groups | |
|---------------|---|
| Closed | <p>A second house is randomly selected and tested.</p> <ul style="list-style-type: none">• If the second house passes, they all pass.• If the second house fails, each home must be tested individually (for just the one measure that failed). |
| Open | <p>A second house is selected (usually the second house ready).</p> <ul style="list-style-type: none">• If the second house passes, it and any remaining houses added to the group pass.• If the second house fails, the group is closed, all homes in the group must be tested, repaired, re-tested, etc. until they pass.• Future homes must be put into a new group. |



Not Allowed

Not Allowed

✦ Sampling is not always allowed, dependent upon the situation.

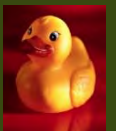
✦ Some HERS measures can never be sampled.



- ✦ Refrigerant charge verification using the weigh-in method (new or altered systems).
- ✦ Altered systems using the “sealing of all accessible leaks” duct leakage verification method.
- ✦ Altered systems where refrigerant charge airflow that cannot meet the 300 cfm/ton requirement and use the alternate approach.



Check your understanding





Sampling Works.... How?

★ Russ house pictures

When subdivisions use sampling, what has to be tested by the HERS rater?

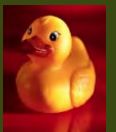
- a) All the measures in ALL the homes
- b) All the measures in any of the homes in the group
- c) All the measures in all the homes if the first house fails
- d) None of the homes if all are tested by the contractor

For alterations to existing homes, which type of group is allowed to be used?

- a) Open group
- b) Closed group
- c) Either of the above

Closed groups are limited to

- a) Duct testing only
- b) Up to 7 homes
- c) Refrigerant charge
- d) All of the above





Next Steps

- Welcome
- What We Heard from You
- Let's Talk

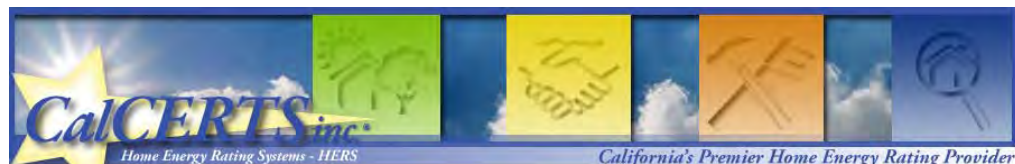
▶ Next Steps

- Best Practices
 - Improvements
- Wrap Up





CalCERTS



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Welcome to CalCERTS

If you are a Current/Returning CalCERTS HERS rater, user or business associate and already have a login and password then proceed to login (to the right top of screen).

If you are New to CalCERTS and are seeking further information, please be sure to read About Us, to get an overview of our expertise and services. Get all of the latest information you need by following the links below.

Access to our online registry data base is restricted to CalCERTS raters, users and other business affiliates.

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- AHRI Introduction
- AHRI Tutorial
- How To do a Total Duct Leakage Test
- How To do a Duct Leakage to Outside Test
- What is HERS and how do I become a rater?
- HERS BPC and EUC alignment.

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 How to register a CF-1R-ALT-HVAC
 How to Transfer a CF-1R-ALT-HVAC Project to a HERS Rater

HERS Rater 'HOW TO' VIDEOS:
 Alterations Non-Residential.
 HERS RATER - What do I do first?
 Advertise on Rater Directory
 Creating an Alteration (Changeout) Project using Option 1
 Creating an Alteration (Changeout) Project using Option 2
 Creating an Alteration (Changeout) Project using Option 3

TUTORIAL VIDEOS FOR ALL:
 Homeowner Alterations Residential Project Registration
 CF-1R Upload for Energy Consultants and HERS Raters
 All About Signature Agreements
 Manage 'My Lists'
 Manage Company Account Information
 Manage Personal Information / Change Password

ENERGYPRO USERS:
 Create Title24 Zip File for CEC Registration
 Create Zip File for Whole House Rating or EEM

MICROPAS USERS:
 Create Title24 Zip File for CEC Registration



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U.S. Energy Raters Association (USERA)



USERA HERS Providership Update
November 14, 2013
OFFICIAL ANNOUNCEMENT:
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Be prepared for the new code. ALL USERA raters must be certified for the new 2013 CEC code by January 1, 2014. USERA is providing an easy way for our raters to smoothly continue their operations without any hiccups as they enter the new year.
A simple one day class.

What's New?

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Re-certification class

11 DEC RE-CERTIFICATION CLASS
Re-certification class

12 DEC RE-CERTIFICATION CLASS
Re-certification class

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Support



For technical support with the USERA HERS Registry

For technical support with the USERA HERS Registry, formerly the CBPCA HERS Registry, please refer to the following tutorials which can be accessed from the registry:

CF-1R Tutorial CF-6R Tutorial

You are welcome to send an email or call and leave a message at any time. Our goal is to respond to all calls and emails within 24 hours.

For tech support contact Stan Bates
sbates@usenergyraters.com or call
888-931-1116.



A new website developed by the Statewide Codes & Standards Program to help you meet the requirements of Title 24, Part 6

We offer **FREE**



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



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* A new program developed by the California Statewide Codes & Standards Program to help you meet the requirements of Title 24, Part 6

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Building Departments -
Use these training kits to easily help your staff and communities decode 2013 Title 24, Part 6!

Now Available:
Quality Insulation Installation

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Crack The Code™ Industry Workshop™

These Industry Workshops are meant to connect California Building Departments to their customers in an effort to simplify Title 24, Part 6 code compliance. We provide a package of materials to help Building Departments facilitate trainings for local installation contractors.

Hosting these workshops is intended to clarify details related to energy code compliance and provides a forum for your department to explain local requirements and processes that will expedite the permit process for you and your local designers and builders. Workshop topics address areas of Title 24, Part 6 energy code that commonly pose challenges for designers, builders, installers and building departments.

Download the file below to get started! Included are all the materials you'll need to host a training:

- Instructor Guide
- Annotated and Customizable PowerPoint Presentation
- Participant Workbook
- Annotated and Customizable Marketing Materials

Quality Insulation Installation

This workshop is designed to enable general contractors and insulation contractors to more easily qualify for the California Building Energy Efficiency Standards (Title 24, Part 6) for residential Quality Insulation Installation (QII). The focus of the workshop is to identify and provide training on how to avoid the most common mishaps with the QII installation & verification processes.

Crack the Code Industry Workshop Materials - Quality Insulation Installation (QII)

Quality Insulation Installation in 2013

Subhead

John Smith, City of Pueblo Building Department

Jane Doe, HERS Rockstar

Date

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2014 Workshop:
Quality Insulation Installation

INSTRUCTOR GUIDE

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2014 Workshop:
Quality Insulation Installation

PARTICIPANT WORKBOOK:

- Team Activity
- Post-course Survey
- Glossary of Terms
- Reference Documents

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Trigger Sheets

2013 Entirely New or Complete Replacement Space-Conditioning System \$150.2(b)1C
 Supply Flex Duct System, incl. starter coils, v's, etc. A space-conditioning system is considered entirely new or a complete replacement when all of the

Required Documentation

For All HVAC Alterations
 All HVAC alterations require:
 Permit — for all HVAC changeouts
 CFIR: Certificate of Compliance: Alteration to an HVAC System (CFIR-ALT-02-E, or CFIR-ALT-03-E or CFIR-ALT-04-E)
 Submitted to the building department by the contractor or the home owner
 CF2R-MCH-01-H: Certificate of Installation for Space Conditioning Systems: Ducts and Fans
 Completed and signed by the installing contractor and made available for final inspection by building department

or HERS Measures
 Projects with HERS measures require:
 Registration of the CFIR, via HERS Provider
 CF2R-MCH-H: Certificates of Installation for mechanical system with HERS measures
 Completed and signed by the installing contractor, must be submitted to a HERS Provider Registry after the contractor has signed it, and made available for inspection by the building department
 CF3R-MCH-H: Certificates of Field Verification for mechanical system with HERS measures
 Completed and required by a HERS Rater for each VESR in the HERS Rater

Ace Resources Title 24 Part 6 Residential Triggers Sheet

HVAC Alterations

| Split Systems and Packaged Systems | Mandatory Measures | | | | Prescriptive Requirements | | |
|--|---|--|--|---|--|--|---|
| | Setback Thermostat \$110.2(a) \$150.2(b)F | Cooling Load Calcs \$150.2(a) \$150.2(b)1C | Heating Load Calcs \$150.0(b) \$150.2(b)1C | HERS: Duct Seal and Test \$150.0(m) 3 & 11 \$150.2(b)1C, D, & E | HERS: Cooling Coil Airflow and Fan Watt Draw \$150.0(m) 12, 13 & 15 \$150.2 (b)1C, D | Duct Insulation \$150.1(c)9 \$150.2(b)1D | HERS: Refrigerant Charge \$150.1(c)17 A \$150.2(b)1 F |
| Change this (and nothing else) | | | | | | | |
| Whole split or packaged system (no ducts added or replaced) | YES | no | no A | YES B | no | no | YES C, D |
| Evaporator coil (cooling coil), condenser coil, or outdoor condensing unit | YES | no | no A | YES B | no | no | YES C, D |
| Furnace (air handler) | YES | no | no A | YES B | no | no | YES C, D |
| Compressor, refrigerant metering device | YES | no | no A | no | no | no | YES C, D |
| Some ducts | no | maybe E | maybe A, E | YES B | no | YES F | no |
| *All new* ducts G | no | maybe E | maybe A, E | YES H | YES I | YES F | no |
| Whole split or packaged system and all new ducts | YES | YES E | YES A, E | YES H | YES I | YES F | YES C, D |

NOTE:
 + Replacing the blower wheel fan is considered a repair and does NOT trigger the Standards.
 + All new HVAC equipment must meet minimum federal efficiency requirements
 + Cooling line insulation is triggered if the line set (cooling system, suction line) is replaced or repaired. Line sets $\leq 1.5"$ in diameter

- A Heating equipment must meet CBC minimum capacity requirements.
- B Unless exceptions apply, duct systems must be sealed and verified if >40 feet of ducts in unconditioned space. Duct system is if unable to meet the sealing requirements, all accessible leaks must be sealed and verified by a HERS rater.
- C HERS verification of refrigerant charge is required in climate zones 2 and 8-15 only when a refrigerant containing component installed in an existing building.
- D Although there are no commercially available HVAC systems with approved Charge Indicator Display (CID) devices at the time a CEC-approved CID should such equipment become available during the 2013 code cycle.
- E Cooling and heating load calculations are required when ducts are added to serve new conditioned space, such as an addit
- F When adding or replacing >40 feet of ducts in unconditioned space: CZ 1-10 and 12-13; R-6, CZ 11 and 14-18; R-8. HERS vs space. Mandatory duct insulation requirements (R-6) apply to all new or replacement ducts (not existing or unaltered ducts).
- G The system is considered to have "all new" ducts when 75% or more of the ducts are new material and up to 25% reused part boots, air handler, coil, plenums, duct material) if the reused parts are accessible and can be sealed to prevent leakage.
- H In all climate zones, when new duct systems are installed in unconditioned space, leakage must be $\leq 6\%$ of the air handler air
- I When new duct systems are installed, cooling coil airflow must be ≥ 350 CFM per ton, and fan watt draw must be ≤ 58 W/CFM Table 150.0-C or Table 150.0-D (Return Duct Sizing and Filter Sizing).



This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support

Ace Resources Title 24 Part 6 Nonresidential Triggers Sheet

Small Commercial HVAC Alterations

Ace Resources Title 24 Part 6 Nonresidential Triggers Sheet

Small Commercial HVAC Alterations

| Packaged Units — Single-zone, Constant Air Volume (CAV) — and Split Systems | Mandatory Measures | | | | | | | Prescriptive Requirements | | | | | | |
|---|--|---|---|---|--|---|--|--------------------------------------|---|---|---|----------------------------------|------------------------------------|---|
| | Total Cooling Capacity \$120.2(a) \$150.2(b)1C | Supply & Exhaust Compens. \$120.2(b) \$150.2(b)1C | Cooling Efficiency \$110.2(a) \$110.2(a)1 | Heating Efficiency \$110.2(a) \$110.2(a)1 | Ventilation Calcs \$120.0(a) \$120.0(a)1 | Demand Control Ventilation \$120.0(a) \$120.0(a)1 | Duct Insulation \$120.0(a) \$120.0(a)1 | Demand Shed Controls \$120.2 \$120.2 | Cooling Load Calcs \$140.0(a) \$140.0(a)1 | Heating Load Calcs \$140.0(a) \$140.0(a)1 | Equipment Sizing \$140.0(a) \$140.0(a)1 | Fan Power \$140.0(a) \$140.0(a)1 | Economizers \$140.0(a) \$140.0(a)1 | Duct Seal & Test \$140.0(a) \$140.0(a)1 |
| Change this (and nothing else) | | | | | | | | | | | | | | |
| Whole Pkg Unit for split system | YES | YES | YES | YES | YES | YES | NO | YES | YES | YES | YES | YES | YES | YES |
| NO DUCTS | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES |
| Cooling Coil of Packaged System | YES | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES |
| Split System, Outdoor Unit | YES | NO | YES | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES |
| Split System, Indoor Unit | YES | NO | YES | YES | NO | NO | NO | NO | NO | NO | NO | YES | NO | YES |
| Some ducts | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO | NO | NO | NO | YES |
| $\geq 75\%$ ducts | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO | NO | NO | NO | YES |
| $\geq 75\%$ new ducts and Whole Pkg Unit and Split System | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |

NOTE: + For Nonresidential HVAC systems, a change in blower motor, compressor, condenser coil, or plenum is considered a repair and does not trigger the Title 24, Part 6 Standards

- If system is single-zone with any controls or multi-zone with direct digital control, and has outside economizer, and serves a high-density space (≥ 25 people per 1,000 ft²)
- Only required if the airside unit has direct digital controls (DDC) to the zone level.
- If total system fan power is ≥ 25 hp
- If $\geq 54,000$ Btu/h cooling capacity (4.5 tons)
- If CAV single-zone system and serves $\geq 25,000$ ft² conditioned floor area and $\geq 25\%$ duct surface in unconditioned space including under a roof that does not meet current prescriptive insulation requirements.
- If split system operates as a heat pump, heating efficiency must meet mandatory requirements in §110.2.



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.

| Direct Digital Control | Demand Shed Controls |
|------------------------|----------------------|
| Direct digital control | Demand response |
| YES | YES |
| NO | NO |
| YES | YES |
| NO | NO |
| YES | YES |
| NO | NO |

is not trigger the Title 24, Part 6 Standards

people (≥ 25 people per 1,000 ft²)

California Gas Company and Southern California Edison. All other modifications. See the PSC's Service and O&M rules for more information on the necessary compliance and details of any other requirements that will not trigger any penalties or fines.



Fact Sheet



Permit Process

When do you need a permit?

Whether the project is residential or nonresidential, many construction processes will require that a permit is obtained from the local Building Department. Work on new construction or existing buildings that require permitting include installation, additions, and alterations of systems such as building envelope, plumbing, mechanical, and electrical.

TIP: Even though the building code is developed at the state level, permit requirements vary by jurisdiction. Contact your local building department to ensure that all code compliance requirements are being met. Use your local building department as a resource!

Permits for some types of simple projects may be issued at the building department counter with minimal documentation, while other more extensive projects require longer review by a plans examiner. In addition to regular field inspections by a building inspector, verification of specific systems may be needed by a HERS Rater and testing of certain equipment by an Acceptance Test Technician may be necessary when triggered by the code.

Permit Application

Depending on the scope of the project, obtaining a permit can be as simple as visiting the counter technician, while larger projects will require an appointment with a plans examiner to look at detailed plans and forms. If a plan review is required, proper preparation saves significant time.

TIP: Some jurisdictions have online permitting available for common small projects such as changing out a water heater.

Getting Ready for a Permit Application:

- **Assemble complete documentation**
 - ◊ Scope of work
 - ◊ Plan set (or equipment schedule depending on building department and scope of work)
 - ◊ Title 24 part 6 compliance paperwork (included within plan set if plans are submitted)
- **Budget for services**
 - ◊ Permit fees
 - ◊ Energy Consultant if needed
- **Schedule considerations**
 - ◊ Permit application turnaround time
 - ◊ Energy Consultant to complete paperwork
 - ◊ Contact HERS Rater to incorporate verification into schedule (<http://www.energy.ca.gov/HERS/formwders.html>)

Installation & Inspection

Once construction is underway the general contractor and specialty contractors are responsible for completing and submitting various Certificates of Installation that certify regulated energy features such as windows, skylights, water heater and plumbing, insulation, HVAC

systems, etc. are installed according to code. If a change order occurs it is the responsibility of the permit applicant to verify that the change does not affect code compliance.

TIP: Getting the Certificates of Installation from specialty contractors such as HVAC, plumbing, or insulation prior to their leaving the site is strongly recommended!

Additional Residential Requirements. When HERS verification is required, Certificates of Installation must be registered with an approved HERS provider data registry. Upon registry of the Certificates, the builder or installing contractor must electronically sign the form and provide a copy to the HERS Rater and homeowner, as well as post onsite for review by the local enforcement agency's inspector.

Additional Nonresidential Requirements. For permit applications submitted on or after January 1, 2015, all of the Certificate of Installation forms must be registered documents from an approved nonresidential data registry. New for the 2013 code, Building Commissioning will be required for all new nonresidential buildings and additions 10,000 ft² or greater. For buildings that are less than 10,000 ft², only the design review sections must be completed.

Acceptance Testing & Field Verification

Certain systems and equipment must be field tested to ensure proper calibration, installation, and operational efficiency. These requirements differ between residential and nonresidential projects, as outlined below.

Residential. Called "Field Verification and/or Diagnostic Testing", these must be completed by a HERS Rater and reported to a HERS registry.

- All newly constructed homes must have tested:
- Duct sealing (leakage testing)
 - Duct system airflow (and installed hsp/pssp)
 - Fan watt draw
 - Whole House Ventilation

Nonresidential. Called "Acceptance Testing", these tests must be completed by an Acceptance Test Technician, HERS Rater, or Installer as indicated by the forms. A completed Certificate of Acceptance is provided by the installing contractor or Acceptance Test Technician. As of January 1, 2015, Certificates of Acceptance must be registered in an approved nonresidential data registry.

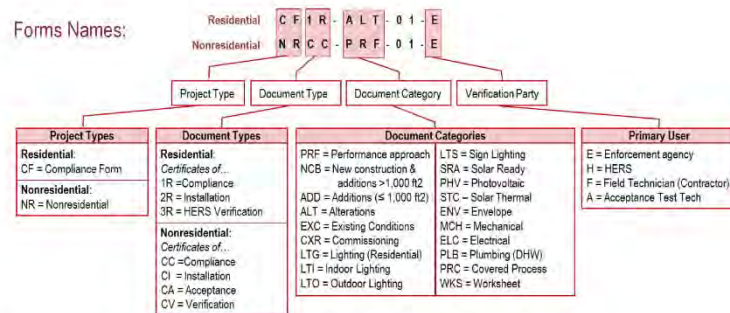
TIP: It is very important to have this available onsite before the inspector arrives for final inspection.

Some examples of Nonresidential systems requiring "Acceptance Testing" include:

- Lighting
- HVAC
- Controls
- Air distribution ducts
- Envelope features

The final step in the permit process is issuance of an Occupancy Permit. Upon project completion, the general contractor or design team is required to leave Certificates of Compliance, Installation, Acceptance and Field and Diagnostic Testing with the building owner.

Forms Names:



Forms Process:

| Residential | | | |
|--|--|--|---|
| When | Who | Documents | Tasks |
| Permit Application | Building department matches to plans; alerts others as to what is expected | + CF1Rs | <ul style="list-style-type: none"> • Prescriptive or Performance Approach • HERS Registered if necessary • Compliance documents must be included on plans if scope of work includes plans |
| Construction | Builders refer to plans and compliance forms (part of the plan set) | + CF2Rs | <ul style="list-style-type: none"> • Contractors must complete the Certificates of Installation |
| Inspection, Field Verification, and Diagnostic Testing | Building Inspectors' and HERS Raters' activities are guided by plan set | + CF3Rs | <ul style="list-style-type: none"> • Must be completed, registered, and signed/certified by the HERS rater |
| Nonresidential | | | |
| When | Who | Documents | Tasks |
| Permit Application | Building department match to plans; alert others as to what is expected | + NRCCs | <ul style="list-style-type: none"> • Prescriptive or Performance Approach • HERS Registered if necessary |
| Construction | Builders refer to plans and compliance forms (part of the plan set) | + NRCCs + NRCLs | <ul style="list-style-type: none"> • Contractors must complete the CI's |
| Inspection, Field Verification, and Diagnostic Testing | Building Inspectors' and HERS Raters' activities are guided by plan set | + NRCCs + NRCLs + NRCLs + NRCLs | <ul style="list-style-type: none"> • NRCCs and NRCLs reviewed by Building Inspector (BI) • NRCA completed by installing contractor or Acceptance Test Technician and reviewed by BI • NRCLs completed by HERS Rater and reviewed by BI |



www.energycodeace.com

A new site developed by the California Statewide Codes & Standards Program here to help you meet the requirements of Title 24, Part 6.



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CEC-2013-07-001-001



Decoding HERS - Handout



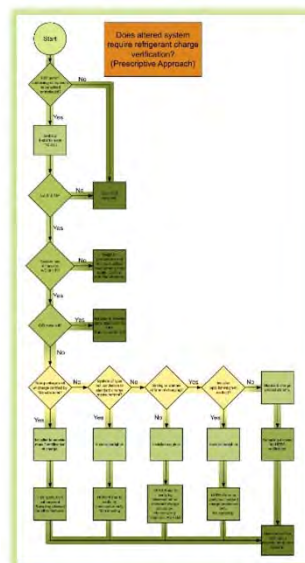
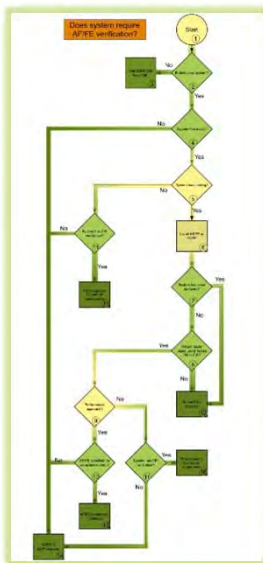
Decoding HERS: Let's Talk Residential and Nonresidential HERS Measures

Host:
Gina Rodda
Gabel Associates, LLC

Guest Speaker:
Russ King
Benningfield Group



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.



2013 Residential HERS Measures

| Measure | Mandatory | Prescriptive | Performance | Reference Appendices # |
|---|-------------|---------------------------|---------------|------------------------|
| Mechanical | | | | |
| Duct sealing (maximum leakage) | §150.0(m)11 | | | 3.1 |
| Indoor air quality ventilation (consistent with ASHRAE Standard 62.2) | §150.0(e) | | | 3.7 |
| Refrigerant charge or installation of a charge indicator display (CID) | | CZ 2, 8-15 §150.1(c)7A | CZ 1, 3-7, 16 | 1.2, 3.2 |
| Duct design (reduced surface area, high insulation, and duct location) | | | X | 3.1 |
| Ducts entirely in conditioned space | | §150.1(c)9 | X | 3.1 |
| Low leakage ducts entirely in conditioned space | | | X | 3.1 |
| Ducts <12 feet outside conditioned space | | | X | 3.1 |
| Low leakage air handlers | | | X | 3.1 |
| Cooling coil air flow and air handler fan watt draw OR Verified return duct design and air filter device | §150.0(m)13 | | | 3.1, 3.3 |
| High SEER and/or High EER | | | §150.1(b)4B | 3.4 |
| Photovoltaic (PV) system capacity to qualify for PV rebate via New Solar Home Partnership | | | X | 4.6 |
| Central fan integrated ventilation cooling systems | | §150.1(C)10 | | 3.3 |
| Zonal control for compliance credit | | | X | 3.3 |
| Evaporatively cooled condensers | | | X | 3.1, 3.2, 3.4 |
| Ice storage air conditioners | | | X | 4.3 |
| Envelope | | | | |
| Quality insulation installation (QII) | | | X | 3.5 |
| Building envelope sealing | | | X | 3.8 |
| Plumbing | | | | |
| Pipe insulation | | | X | 3.6 |
| Verified design (parallel piping, compact design, point of use) | | | X | 3.6 |
| Multi-Family recirculation loops | | | X | 3.6 |

2013 Nonresidential HERS Measures

| Measure | Mandatory | Prescriptive | Performance | Reference Appendices # |
|--|-----------|--------------|-------------|------------------------|
| Mechanical | | | | |
| Duct sealing (maximum leakage) | | §140.4(l) | | 3.1 |
| Low leakage air handlers | | | §110.2(f) | 3.1 |
| Plumbing | | | | |
| Multi-Family/Hotel & Motel recirculation systems (piping and controls) | | | X | 4.4 |
| Multi-Family/Hotel & Motel pipe insulation | | | X | 4.4 |



Our Question To You



Do you have a tool, practice or tip to share that helps insure a successful final inspection in respects to HERS measures?

*The HERS
registration process
that guides you
through the
requirements.*



Wrap Up

- Welcome
- What We Heard from You
- Let's Talk
- Next Steps

▶ **Wrap Up**

- Thank you!
- Questions?
- CEUs





Thank you!

| Contact | Role | Email | Phone |
|-----------------|---|--|---------------------------|
| Gina Rodda | Presenter | gina@gabelenergy.com | (510) 428-0803 ext 204 |
| Russ King | Guest Speaker | russ.king@benningfieldgroup.com | (916) 446-2239 |
| Kathryn Fortin | eLearning Technology & Design Consultant | kfortin@fortech.net | (510) 825-3508 |
| Energy Code Ace | Webinar Registration | online.training@energycodeace.com | |
| CEC Hotline | Energy Standards Hotline | title24@energy.ca.gov | (800) 772-3300 |
| Jill Marver | PG&E Course Manager | JKZ1@pge.com | (925) 415-6844 |



HELPING YOU PLAY YOUR CARDS RIGHT



Permit Process

When do you need a permit?

Whether the project is residential or nonresidential, many construction processes will require that a permit is obtained from the local Building Department. Work on new construction or existing buildings that require permitting include installation, additions, and alterations of systems such as building envelope, plumbing, mechanical, and electrical.

TIP: Even though the building code is developed at the state level, permit requirements vary by jurisdiction. Contact your local building department to ensure that all code compliance requirements are being met. Use your local building department as a resource!

Permits for some types of simple projects may be issued at the building department counter with minimal documentation, while other more extensive projects require longer review by a plans examiner. In addition to regular field inspections by a building inspector, verification of specific systems may be needed by a HERS Rater and testing of certain equipment by an Acceptance Test Technician may be necessary when triggered by the code.

Permit Application

Depending on the scope of the project, obtaining a permit can be as simple as visiting the counter technician, while larger projects will require an appointment with a plans examiner to look at detailed plans and forms. If a plan review is required, proper preparation saves significant time.

TIP: Some jurisdictions have online permitting available for common small projects such as changing out a water heater.

Getting Ready for a Permit Application:

+ Assemble complete documentation

- ✧ Scope of work
- ✧ Plan set (or equipment schedule depending on building department and scope of work)
- ✧ Title 24 part 6 compliance paperwork (included within plan set if plans are submitted)

+ Budget for services

- ✧ Permit fees
- ✧ Energy Consultant if needed

+ Schedule considerations

- ✧ Permit application turnaround time
- ✧ Energy Consultant to complete paperwork
- ✧ Contact HERS Rater to incorporate verification into schedule (<http://www.energy.ca.gov/HERS/providers.html>)

Installation & Inspection

Once construction is underway the general contractor and specialty contractors are responsible for completing and submitting various Certificates of Installation that certify regulated energy features such as windows, skylights, water heater and plumbing, insulation, HVAC

systems, etc. are installed according to code. If a change order occurs it is the responsibility of the permit applicant to verify that the change does not affect code compliance.

TIP: Getting the Certificates of Installation from specialty contractors such as HVAC, plumbing, or insulation prior to their leaving the site is strongly recommended!

Additional Residential Requirements. When HERS verification is required, Certificates of Installation must be registered with an approved HERS provider data registry. Upon registry of the Certificates, the builder or installing contractor must electronically sign the form and provide a copy to the HERS Rater and homeowner, as well as post onsite for review by the local enforcement agency's inspector.

Additional Nonresidential Requirements. For permit applications submitted on or after January 1, 2015, all of the Certificate of Installation forms must be registered documents from an approved nonresidential data registry. New for the 2013 code, Building Commissioning will be required for all new nonresidential buildings and additions 10,000 ft² or greater. For buildings that are less than 10,000 ft², only the design review sections must be completed.

Acceptance Testing & Field Verification

Certain systems and equipment must be field tested to ensure proper calibration, installation, and operational efficiency. These requirements differ between residential and nonresidential projects, as outlined below.

Residential. Called "Field Verification and/or Diagnostic Testing", these must be completed by a HERS Rater and reported to a HERS registry.

All newly constructed homes must have tested:

- + Duct sealing (leakage testing)
- + Duct system airflow (and installed hspp/pspp)
- + Fan watt draw
- + Whole House Ventilation

Nonresidential. Called "Acceptance Testing", these tests must be completed by an Acceptance Test Technician, HERS Rater, or Installer as indicated by the forms. A completed Certificate of Acceptance is provided by the installing contractor or Acceptance Test Technician. As of January 1, 2015, Certificates of Acceptance must be registered in an approved nonresidential data registry.

TIP: It is very important to have this available onsite before the inspector arrives for final inspection.

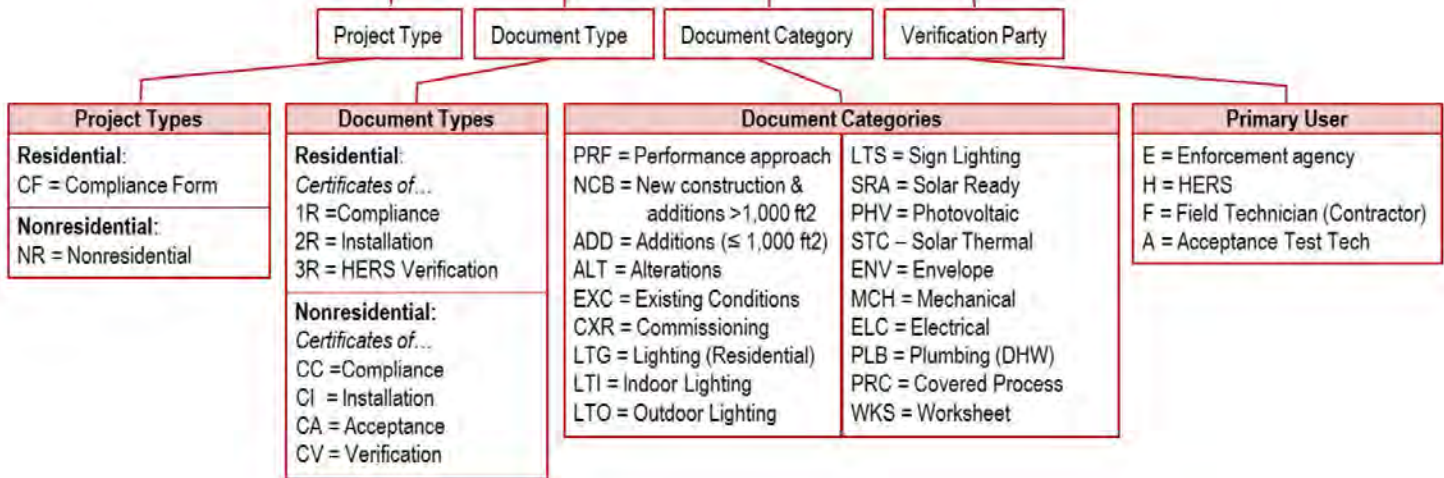
Some examples of Nonresidential systems requiring "Acceptance Testing" include:

- + Lighting
- + HVAC
- + Controls
- + Air distribution ducts
- + Envelope features

The final step in the permit process is issuance of an Occupancy Permit. Upon project completion, the general contractor or design team is required to leave Certificates of Compliance, Installation, Acceptance, and Field and Diagnostic Testing with the building owner.

Forms Names:

Residential **C F 1 R - A L T - 0 1 - E**
 Nonresidential **N R C C - P R F - 0 1 - E**



Forms Process:

Residential

| When | Who | Documents | Tasks |
|--|--|-----------|--|
| Permit Application | Building department matches to plans; alerts others as to what is expected | + CF1Rs | <ul style="list-style-type: none"> Prescriptive or Performance Approach HERS Registered if necessary Compliance documents must be included on plans if scope of work includes plans |
| Construction | Builders refer to plans and compliance forms (part of the plan set) | + CF2Rs | <ul style="list-style-type: none"> Contractors must complete the Certificates of Installation |
| Inspection, Field Verification, and Diagnostic Testing | Building Inspectors' and HERS Raters' activities are guided by plan set | + CF3Rs | <ul style="list-style-type: none"> Must be completed, registered, and signed/certified by the HERS rater |

Nonresidential

| When | Who | Documents | Tasks |
|--|---|---|---|
| Permit Application | Building department match to plans; alert others as to what is expected | + NRCCs | <ul style="list-style-type: none"> Prescriptive or Performance Approach HERS Registered if necessary |
| Construction | Builders refer to plans and compliance forms (part of the plan set) | + NRCCs + NRCIs | <ul style="list-style-type: none"> Contractors must complete the CI's |
| Inspection, Field Verification, and Diagnostic Testing | Building Inspectors' and HERS Raters' activities are guided by plan set | + NRCCs + NRCIs + NRCAAs + NRCVs | <ul style="list-style-type: none"> NRCCs and NRCIs reviewed by Building Inspector (BI) NRCA completed by installing contractor or Acceptance Test Technician and reviewed by BI NRCVs completed by HERS Rater and reviewed by BI |



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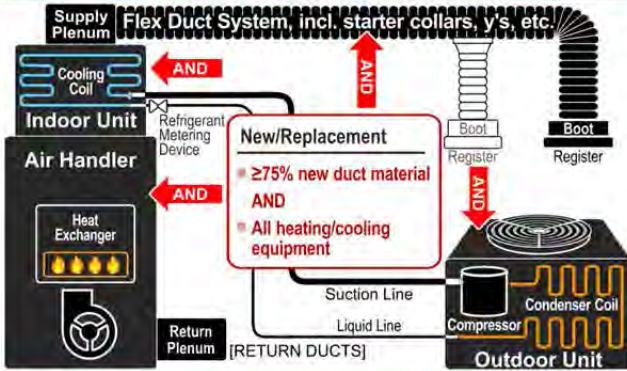
| Split Systems and Packaged Systems | Mandatory Measures | | | | | Prescriptive Requirements | |
|--|---|---|---|---|---|--|---|
| | Setback Thermostat §110.2(c) §150.2(b)F | Cooling Load Calcs §150.0(h), §150.2(b)1C | Heating Load Calcs §150.0(h), §150.2(b)1C | HERS: Duct Seal and Test §150.0 (m)1-3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

NOTE:

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

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

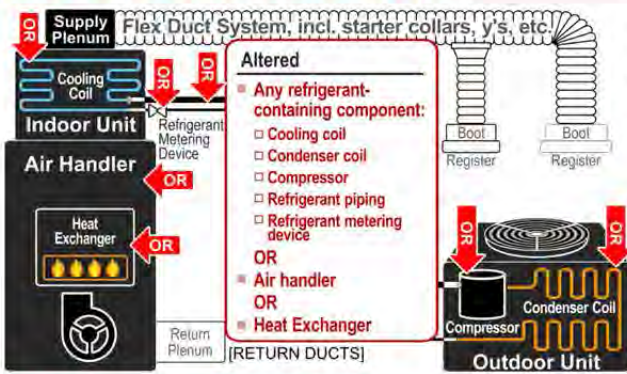
2013 Entirely New or Complete Replacement Space-Conditioning System §150.2(b)1C



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

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

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



A space-conditioning system is considered altered when it is not a new or replacement system and any of the following components is installed or replaced:

- ✦ Any refrigerant-containing component, including:
 - ✧ Cooling coil
 - ✧ Condenser coil
 - ✧ Compressor
 - ✧ Refrigerant piping
 - ✧ Refrigerant metering device
 - ✧ Air handler
 - ✧ Heat exchanger

Replacing other components is considered a repair — not an alteration. For example, replacing the blower wheel fan, but not the heat exchanger or air handler in the furnace, is a repair.

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



Entirely New or Complete Replacement Ducts

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

The Duct Sealing and Testing HERS measure must demonstrate a leakage rate less than or equal to 6% of the system air handler airflow. In addition, verification of Cooling Coil Airflow and Fan Watt Draw (HERS measure) is required. The system must have airflow >350 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy ≤0.58 W/CFM.



Alteration or Extension of Existing Ducts

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

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

Required Documentation

For All HVAC Alterations

All HVAC alterations require:

- ✦ Permit — for all HVAC changeouts
- ✦ CF1R: Certificate of Compliance: Alteration to an HVAC System (CF1R-ALT-02*-E, or CF1R-ALT-03-E or CF1R-ALT-04-E) Submitted to the building department by the contractor or the home owner
- ✦ CF2R-MCH-01-H: Certificate of Installation for Space Conditioning Systems, Ducts and Fans Completed and signed by the installing contractor and made available for final inspection by building department

For HERS Measures

Projects with HERS measures require:

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

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

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

- ✦ CF2R-MCH-28-H and CF3R-MCH-28-H

Small Commercial HVAC Alterations

Packaged Units — Single-zone, Constant Air Volume (CAV) — and Split Systems

| Change this (and nothing else) | Mandatory Measures | | | | | | | | Prescriptive Requirements | | | | | |
|---|--|---|--|--|---|---|------------------------------|---|---------------------------------------|---------------------------------------|---|--|---|--|
| | Tstat §110.2(c) §120.2 (a), (b), (c) & (e) | Supply & Exhaust Dampers (ventilation provided by HVAC) §120.2(f) | Min. Cooling Efficiency §110.2(a) | Min. Heating Efficiency §110.2(a) | Ventilation Calcs (NRCC- MCH-03-E) §120.1 | Demand Control Ventilation ^A §120.1(c) 3 & 4 | Duct Insulation §120.4 | Demand Shed Controls ^B §120.2 | Cooling Load Calcs §140.4(b) | Heating Load Calcs §140.4(b) | Equipment Sizing (per load calcs) §140.4(a) | Fan Power ^C §140.4(c) | Econo- mizer ^D §140.4(e) | Duct Seal & Test ^E §140.4(l), 140.9(b)(2)E |
| Whole Pkg Unit Or split system NO DUCTS | YES | YES | YES | YES | YES | YES ^A | NO | YES ^B | YES | YES | YES | YES ^C | YES ^D | YES ^E |
| Cooling Coil of Packaged System | YES | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES ^E |
| Split System, Outdoor Unit | YES | NO | YES | YES ^F | NO | NO | NO | NO | NO | NO | NO | NO | NO | YES |
| Split System, Indoor Unit | YES | NO | YES | YES ^F | NO | NO | NO | NO | NO | NO | YES | NO | NO | YES |
| Some ducts | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO | NO | NO | NO | YES ^E |
| ≥75% ducts | NO | NO | NO | NO | NO | NO | YES | NO | NO | NO | NO | NO | NO | YES ^E |
| ≥75% new ducts and Whole Pkg Unit and Split System | YES | YES | YES | YES | YES | YES ^A | YES | YES ^B | YES | YES | YES | YES ^C | YES ^D | YES ^E |

NOTE: + For Nonresidential HVAC systems, a change in blower motor, compressor, condenser coil, or plenum is considered a repair and does not trigger the Title 24, Part 6 Standards.

- ^A If system is single-zone with any controls or multi-zone with direct digital control, and has airside economizer, and serves a high-density space (≥25 people per 1,000 ft²)
- ^B Only required if the altered unit has direct digital controls (DDC) to the zone level.
- ^C If total system fan power is >25 hp
- ^D If >54,000 Btu/h cooling capacity (4.5 tons)
- ^E If CAV single-zone system and serves <5,000 ft conditioned floor area and >25% duct surface in unconditioned space including under a roof that does not meet current prescriptive insulation requirements.
- ^F If split system operates as a heat pump, heating efficiency must meet mandatory requirements in §110.2.

Small Commercial HVAC Alterations

Acceptance Tests: Packaged Units — Single-zone, Constant Air Volume (CAV) — and Split Systems

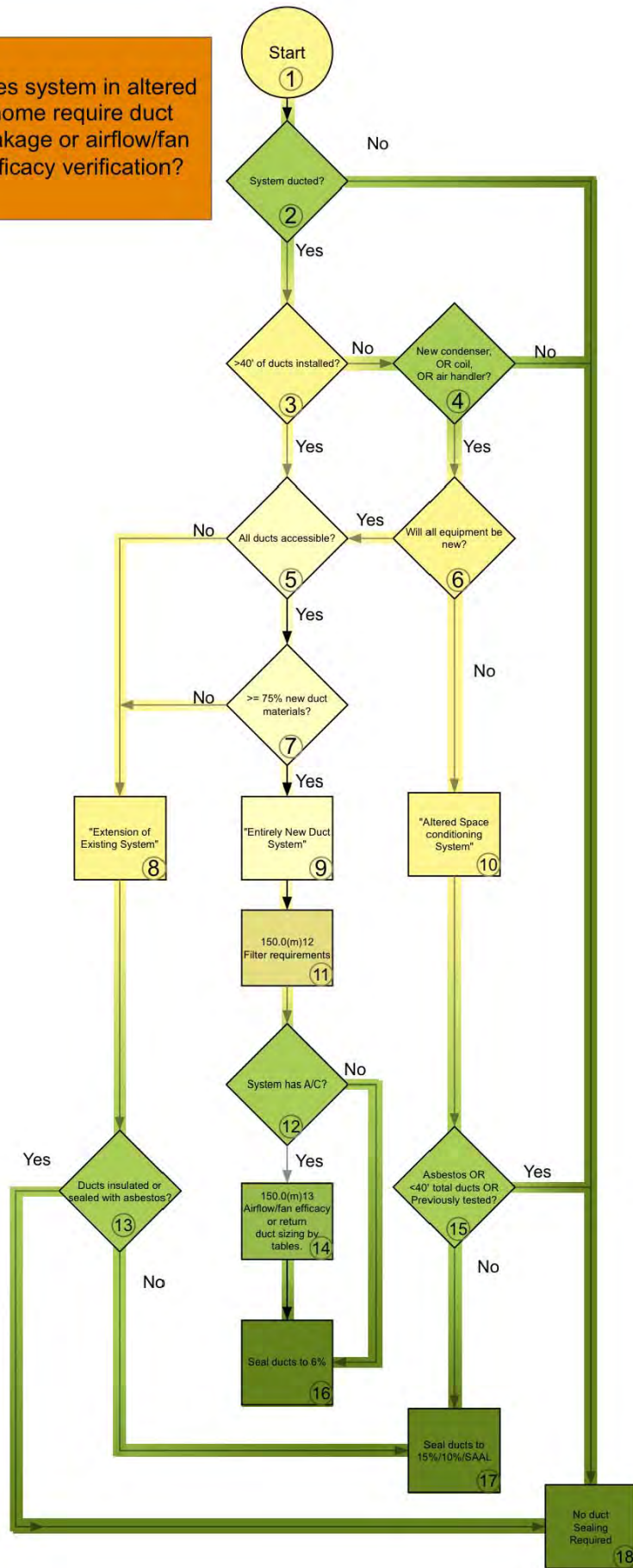
| Change this (and nothing else) | 2013-NRCA-MCH-02-A: Ventilation Systems | 2013-NRCA-MCH-03-A: Constant-volume, Single-zone Unitary A/C and HP Temperature Scheduling & Controls for DX units | 2013-NRCA-MCH-04-H: Air Distribution Systems | 2013-NRCA-MCH-05-A: Air Economizer Controls | 2013-NRCA-MCH-06-A: Demand Control Ventilation | 2013-NRCA-MCH-11-A: Demand Shed Controls |
|--|--|---|---|--|---|---|
| | Adequate OSA (when ventilation provided by HVAC) | Proper system temperature scheduling & controls for DX units | Duct leakage rate | Proper operation of economizer controls | Proper operation of DCV controls | Demand response |
| Whole package unit | YES | YES | YES ^A | YES ^B | YES ^C | YES ^D |
| Cooling coil | NO | NO | YES | NO | NO | NO |
| Entire Split System | YES | YES | YES | YES | YES | YES |
| Some ducts | NO | NO | YES ^A | NO | NO | NO |
| ≥75% ducts | NO | NO | YES ^A | NO | NO | NO |
| ≥75% new ducts and Whole Pkg Unit and Split System | YES ^B | YES | YES ^A | YES ^B | YES ^C | YES ^D |

NOTE: + For Nonresidential HVAC systems, a change in blower motor, compressor, condenser coil, or plenum is considered a repair and does not trigger the Title 24, Part 6 Standards.

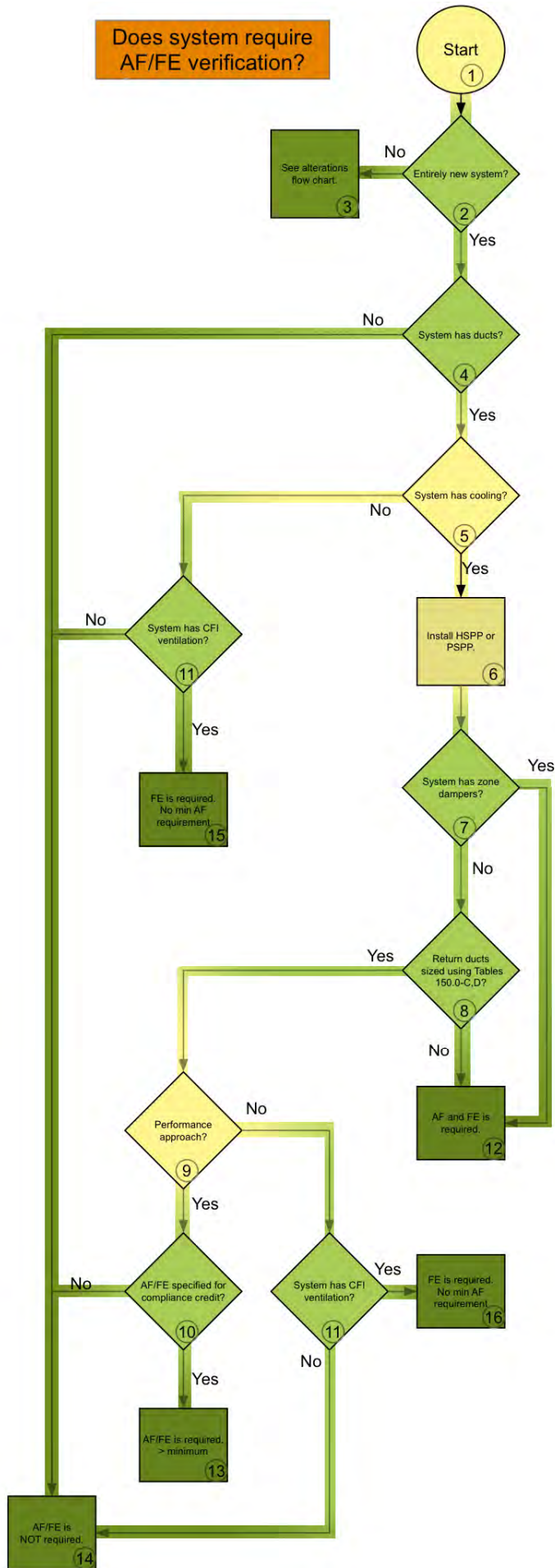
- ^A If ducts are for a single-zone CAV unit serving <5,000 ft, and if >25% duct surface area in unconditioned space
- ^B If the system has an economizer, and it is NOT factory installed and CEC certified
- ^C If system is single-zone with any controls or multi-zone with direct digital control, and has airside economizer, and serves a high-density space (≥25 people per 1,000 ft²)
- ^D The acceptance test requirement only applies if the unit has DDC controls.

Flowchart for Residential HERS Duct Leakage (Appendix E)

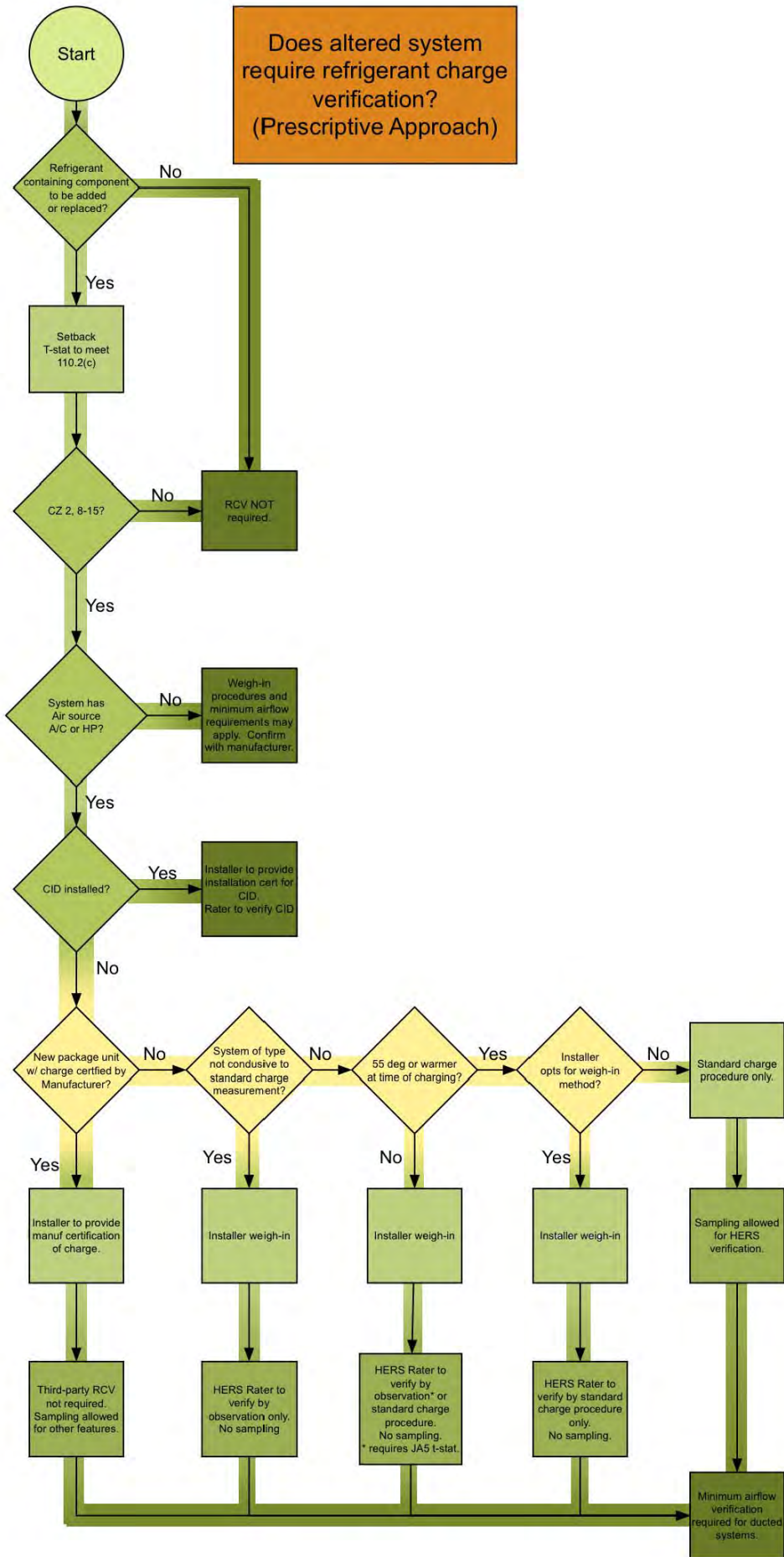
Does system in altered home require duct leakage or airflow/fan efficacy verification?



Flowchart for Residential HERS Air Flow/Fan Watt Draw (Appendix E)



Flowchart for Residential HERS Refrigerant Charge (Appendix E)



2013 Residential HERS Measures

| Measure | Mandatory | Prescriptive | Performance | Reference Appendices # |
|---|--------------|---------------------------|---------------|------------------------|
| Mechanical | | | | |
| Duct sealing (maximum leakage) | \$150.0(m)11 | | | 3.1 |
| Indoor air quality ventilation (consistent with ASHRAE Standard 62.2) | \$150.0(o) | | | 3.7 |
| Refrigerant charge or Installation of a charge indicator display (CID) | | CZ 2, 8-15 §150.1(c)7A | CZ 1, 3-7, 16 | 1.2, 3.2 |
| Duct design (reduced surface area, high insulation, and duct location) | | | X | 3.1 |
| Ducts entirely in conditioned space | | \$150.1(c)9 | X | 3.1 |
| Low leakage ducts entirely in conditioned space | | | X | 3.1 |
| Ducts <12 feet outside conditioned space | | | X | 3.1 |
| Low leakage air handlers | | | X | 3.1 |
| Cooling coil air flow and air handler fan watt draw OR Verified return duct design and air filter device | \$150.0(m)13 | | | 3.1, 3.3 |
| High SEER and/or High EER | | | \$150.1(b)4B | 3.4 |
| Photovoltaic (PV) system capacity to qualify for PV rebate via New Solar Home Partnership | | | X | 4.6 |
| Central fan integrated ventilation cooling systems | | \$150.1(C)10 | | 3.3 |
| Zonal control for compliance credit | | | X | 3.3 |
| Evaporatively cooled condensers | | | X | 3.1, 3.2, 3.4 |
| Ice storage air conditioners | | | X | 4.3 |
| Envelope | | | | |
| Quality insulation installation (QII) | | | X | 3.5 |
| Building envelope sealing | | | X | 3.8 |
| Plumbing | | | | |
| Pipe insulation | | | X | 3.6 |
| Verified design (parallel piping, compact design, point of use) | | | X | 3.6 |
| Multi Family recirculation loops | | | X | 3.6 |

2013 Nonresidential HERS Measures

| Measure | Mandatory | Prescriptive | Performance | Reference Appendices # |
|--|-----------|--------------|-------------|------------------------|
| Mechanical | | | | |
| Duct sealing (maximum leakage) | | \$140.4(l) | | 3.1 |
| Low leakage air handlers | | | \$110.2(f) | 3.1 |
| Plumbing | | | | |
| Multi Family/Hotel & Motel recirculation systems (piping and controls) | | | X | 4.4 |
| Multi Family/Hotel & Motel pipe insulation | | | X | 4.4 |