Davis Field Inspector's Guide

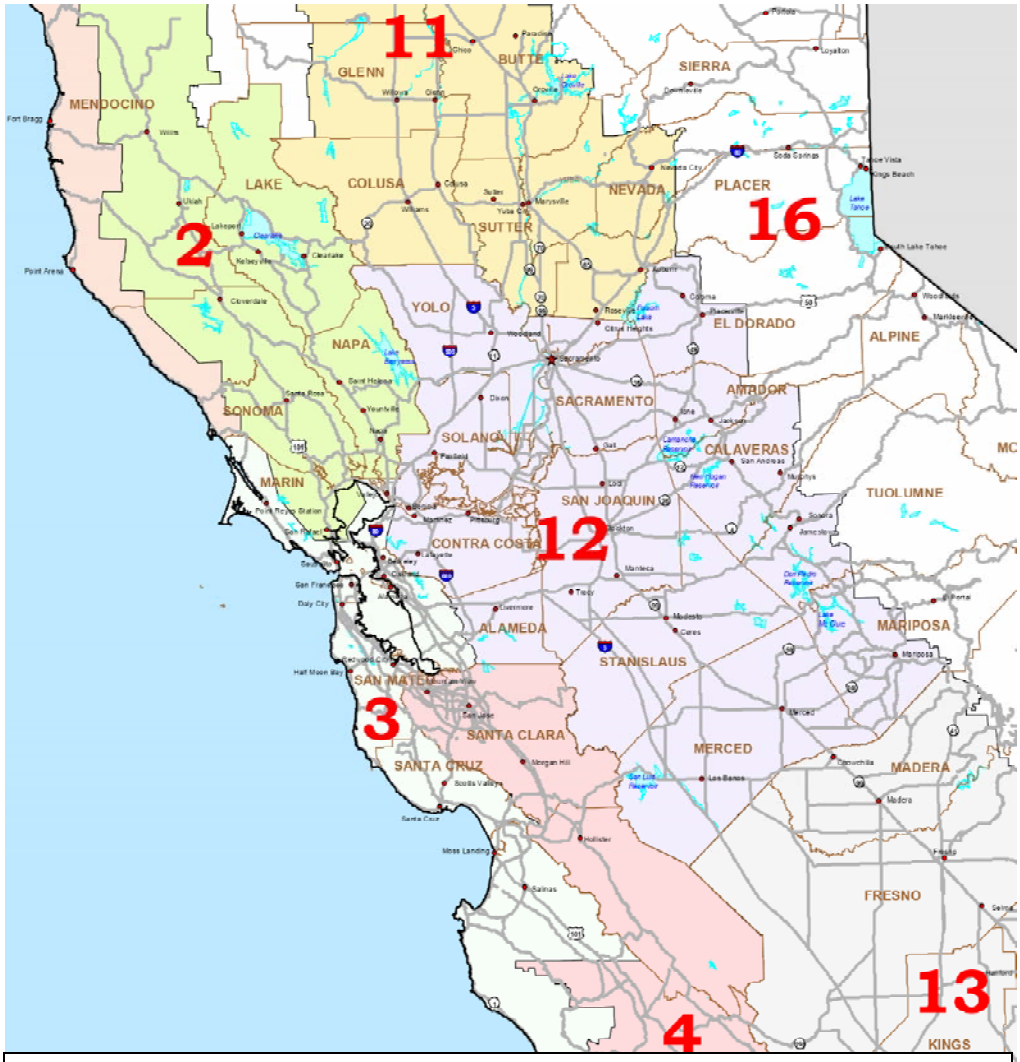
TO THE

2008 Energy Code

FOR PRESCRIPTIVE COMPLIANCE OF

HERS Required Measures

FOR RESIDENTIAL ALTERATIONS



Davis Field Guide #1

Published by the California Building Performance Contractors Association

Preface

The *Davis Field Guide* to the 2008 Energy Code for prescriptive compliance for HERS required measures for residential alterations is a guide for those who need to understand in laymen's language the new code that went into effect for permits issued on or after January 1st, 2010. This guide assumes you have a basic knowledge of the Title 24 code and with this knowledge we attempt to simplify the prescriptive requirements of which measures will be required and when. The information in this guide was taken from publications from the California Energy Commission and are deemed accurate at time of this publication. References from these publications will be noted when applicable. Since this is time sensitive material, if you have any questions about the code or any changes, call the energy hotline at the Energy Commission for any changes or clarifications at: ***1-800-772-3300***.

We have included a two page chart at the end of this guide as a quick reference summarizing the topics contained herein. We hope you enjoy and use this guide to simplify your life!

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Simply put, there are two basic questions that must be answered to know if there is a HERS required measure for duct testing and sealing. If the answer to either of these questions are "no" you can stop right now---there is no HERS required measure for "DTS." But there may still be a requirement for Refrigerant Charge and Airflow (see section 2).

Am I in a climate zone that has a requirement?

Is there more than forty feet (40') of ductwork in unconditioned space?

If the answer is "yes" to both---keep reading.

There is a duct sealing and testing requirement in climate zones 2, 9-16. There is a refrigerant charge and airflow requirement in climate zones 2, 8-15. If you are lucky enough to be in a climate zone where both requirements are (2, 9-15) you will have to do both HERS required measures.

Duct Sealing:

Let's start with the duct sealing and testing requirement. This information is found in the California Energy Commission Residential Compliance Manual, chapter 8 section 8.4.2 "Prescriptive Requirements". We will also make reference to the 2008 Building Energy Efficiency Standards or "Standards".

Alterations:

First, let's talk about an alteration or "HVAC changeout".

"…a space-conditioning system is altered by the installation of or replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger, §152(b)1E requires the ducts to be sealed…"

…And certified by a HERS rater. Also, when more than 40 feet of new or replacement ducts are installed in unconditioned space, HERS verification of duct sealing is required.

There are four options for showing compliance for existing duct systems listed below:

1. Total leakage is less than 15 percent of nominal system fan airflow.

2. Leakage to the outside is less than 10 percent of system fan airflow.

3. Leakage is reduced by more than 60 percent compared to before the alteration and a smoke test shows that all *accessible* leaks have been sealed.

4. If any one option of the above three compliance targets cannot be met, then compliance can be achieved by sealing all *accessible* leaks verified by a HERS rater inspection. ***Sampling is not allowed.***

HERS field verification is required for all options listed above. For options 1, 2, and 3, verification can be accomplished through sampling. For option 4, sampling is not allowed; a certified HERS rater must do the visual inspection and the smoke test on every house that chooses option 4. Procedures for sampling can be found in the Energy Commission's publication "Reference Appendices" in RA2. Procedures for duct testing, smoke test and visual inspection can be found in RA3.

When existing duct systems are constructed, insulated, or sealed with asbestos or any new extended ducts are added to a duct system insulated, or sealed with asbestos, the ducts are exempt from the duct leakage and sealing requirements. Additionally, if a duct system has been previously certified by a HERS rater the duct system is exempt from the duct leakage and sealing requirements (unless more than 40' of ductwork has been added or replaced since the prior certification).

Entirely new or replacement duct system:

The Energy Commission describes ***entirely new or replacement duct system*** as all brand new ducts but it *"can also include existing parts of the original duct system (e.g., register boots, air handler, coil, plenums, etc.) if those parts are accessible and they can be sealed…"*

Compliance for an entirely new or replacement duct system is leakage must be below 6% and must be HERS verified. There is an exception if accessible boots, plenums or an existing air handler are installed. If the 6% target cannot be met, a smoke test must be performed (and HERS verified) to show that leakage is only coming from the air handler and all accessible leaks are sealed.

New or replacement space-conditioning system:

A ***new or replacement space conditioning system*** installed in an existing dwelling includes:

• all of the system heating/cooling equipment (e.g. outdoor condensing unit and indoor cooling or heating coil for split systems; or complete replacement of a package unit), and

• entirely "*new or replacement duct system*", and

• entirely new or replacement air handler.

Compliance for an entirely new or replacement space-conditioning system is leakage must be below 6% and must be HERS verified.

We see that the Energy Commission references the word "accessible". They define accessible as:

"…having access thereto, but which first may require removal or opening of access panels, doors, or similar obstructions. For example, if walls or drywall sections have to be moved or removed, or if the ducts are buried under insulation, or if a joint in the duct system is in too small a space between framing members for someone to be able to access the joint to seal it, then that portion of the duct system is not accessible and is not required to be sealed even if smoke testing determines that the duct leaks in that inaccessible location."

But who really determines the definition of accessible on the job site?

"…compliance by smoke test and sealing all accessible leaks must be determined by a smoke test that has been conducted by a ***HERS rater****."*

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Refrigerant Charge and Airflow:

This information is found in the Residential Compliance Manual, chapter 8 section 8.4.2 “Prescriptive Requirements”. We will also make reference to the 2008 Building Energy Efficiency Standards or “Standards”.

In climate zones 2, 8-15, when a new or replacement or altered split system is installed (air conditioning or heat pump), there must be a refrigerant charge measurement completed and verified by a HERS rater. Besides a refrigerant charge measurement, new for 2008, Standard 151(f)7A states:

“When refrigerant charge measurement or charge indicator display is shown as required by TABLE 151-B, TABLE 151-C or TABLE 151-D, ducted split system central air conditioners and ducted split system heat pumps shall:

i. Have temperature measurement access holes (TMAH) saturation temperature measurement sensors (STMS), and proper refrigerant charge confirmed through field verification and diagnostic testing in accordance with procedures set forth in the Reference Residential Appendix RA3.2”

Before you get too worried, let’s break it down.

Alterations:

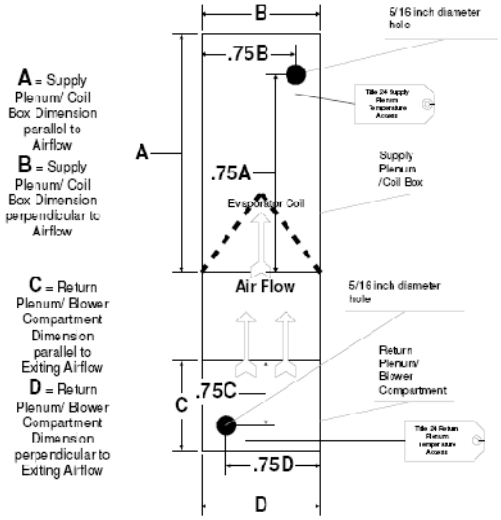
The Standard 152(b)1Fii states:

“When a space-conditioning system is altered by the installation or replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger, the following requirements shall be met:

ii. Meet the refrigerant charge and airflow requirements of Reference Residential Appendix RA3.”

The airflow requirement is at least 300 cfm per nominal ton. This can either be measured or can be verified with the temperature split method.

Along with the refrigerant charge measurement, new for 2008, Temperature Measurement Access Holes (TMAH) must be installed---with labels--- by the contractor and HERS verified. This is to allow the HERS rater a non-intrusive method to verify the airflow using the temperature split method.



New or replacement space-conditioning system:

If the new or replacement space conditioning system (in an existing residential building) is located in climate zones 2, 8, or 9, the HERS required "RCA" measure is the same as those for an alteration. You can stop reading---you're done!

If the new or replacement space conditioning system (in an existing residential building) is located in climate zones 10-15, HERS required measures are the same as those for an alteration PLUS two additional HERS required measures along with the requirement for the contractor providing static pressure probe access and installing saturation temperature measurement sensors.

Additional measure 1:

Cooling Coil Airflow:

The airflow must be at least 350 cfm per nominal ton and be measured (temperature split method is not allowed) and verified by a HERS rater. This measurement can be done with plenum pressure matching, a flow grid device or a flow capture hood. Refer to Residential Appendix RA3.

For example, a 5 ton system must have a minimum measured airflow of 1,750 cfm (5 times 350 equals 1,750).

Additional measure 2:

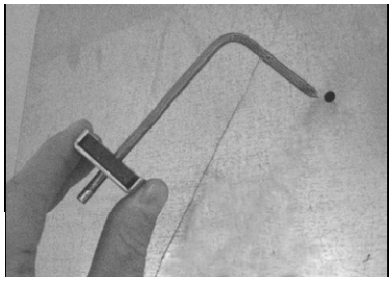
Fan Watt Draw:

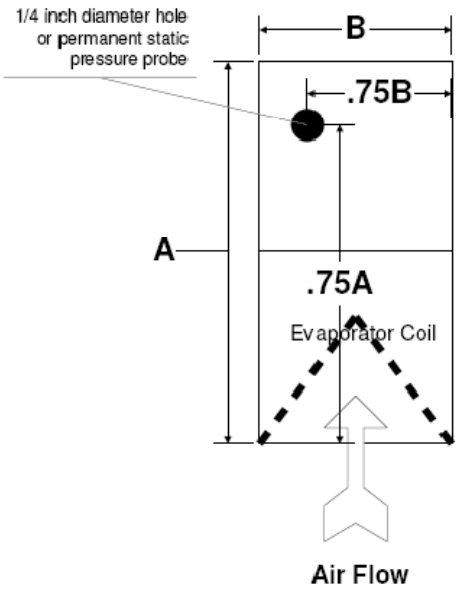
The actual measured (cfm) is multiplied by a factor of 0.58. That is the maximum fan watt draw that is allowed and must be HERS verified. Refer to Residential Appendix RA3.

Example:
A 5 ton system has an actual measured airflow of 1825 cfm. Multiply 1,825 times 0.58. That is 1,058.5. If your measurement is equal to or below that, it is a pass.

Static Pressure Probe (Access):

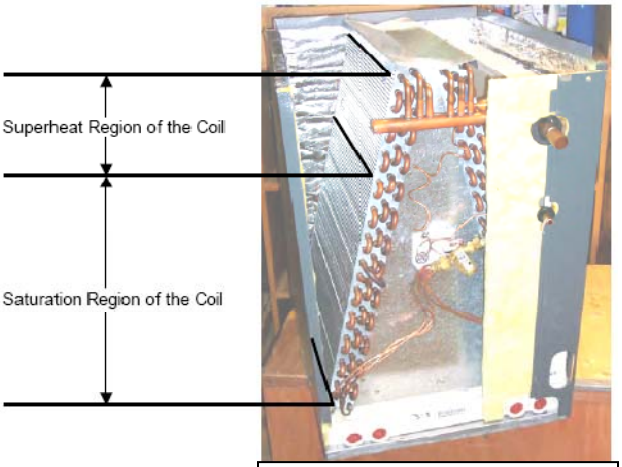
Since cooling coil airflow must be measured, plenum pressure matching and flow grid methods require reading the static pressure off the supply plenum. The static pressure probe can either be permanently installed or the contractor can drill an access hole for one—label it--- so the HERS rater can use a non-intrusive method to read the static pressure.





Saturation Temperature Measurement Sensors (STMS):

This is another non-intrusive method for the HERS rater to complete a refrigerant charge measurement. STMS are installed at the saturation region of the condenser and evaporative coil. With a K type thermocouple, the HERS rater can "plug in" the STMS and read the temperature on a meter instead of attaching refrigerant gauges to the refrigerant lines thus potentially allowing refrigerant to escape and skewing the measurement results.



Evaporative Coil
(interior view)

Final Note on Refrigerant Charge Measurement:

A valid refrigerant charge measurement by a HERS rater can only be done when the outside (ambient dry bulb at the condenser) is 55^0 or higher (standard charge measurement method). An installer is allowed to perform a "weigh-in" method for compliance but a HERS rater must use the standard charge measurement method. The enforcement agency (building department) may accept the installer's Certificate of Installation (CF-6R-Mech-26-HERS) to close out or "final" the permit with the certification from the installer that when a HERS verification is completed, if such verification demonstrates the refrigerant charge measurement does not pass, the installer, at no charge to the homeowner, will return and correct the charge (Residential Appendix RA2.4.4). If an installer uses the weigh-in method, it cannot be part of a sample group and must be HERS verified using the standard charge measurement method.

You may have noticed that we reference "split systems", that is because package units are exempt from the refrigerant charge measurement requirement.

Unlike the duct sealing and testing requirement, the refrigerant charge requirement does not have a 40' duct length in unconditioned space rule. This HERS required measure must be performed regardless on the length of the duct system, in unconditioned space or not. The installation of a charge indicator display (CID), if verified by a HERS rater, 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. In other words, if a CID is installed, no refrigerant charge measurement is required---that is because the CID is a refrigerant charge measurement device! As of this publication, there is currently no CID on the market.

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Required Documentation:

CF-1R ALT (-HVAC)

A Certificate of Compliance (CF-1R ALT) is required to issue a permit (be aware some enforcement agencies, at this time, may not be asking for them at time of permit issuance but it is required documentation). This document is provided by the contractor (or homeowner) stating what type of equipment is being installed, its minimum efficiency, and configuration. It also summarizes what HERS measures are required. The CEC has recently released several new CF-1R-ALT-HVAC forms for HVAC changeouts specific to certain climate zones making the form easier to complete and understand.

There are seven Certificate of Installation (CF-6R) forms.

CF-6R-Mech-04

The CF-6R-Mech-04 is always required. It tells the homeowner, the enforcement agency and the HERS rater what equipment was installed. The HERS rater checks this form against the CF-1R ALT to confirm that the minimum efficiency that was ostensibly to be installed has actually been installed. Not a registered document.

CF-6R-Mech-20-HERS

The contractor completes this duct leakage test form when a new or replacement duct system has been installed.

CF-6R-Mech-21-HERS

The contractor completes this duct leakage test form for an existing duct system.

CF-6R-Mech-22-HERS

The contractor completes this form for HSPP/PSPP Installation; Cooling Coil Airflow & Fan Watt Draw Test.

CF-6R-Mech-24-HERS

The contractor completes this form for Charge Indicator Display as an alternative to the Refrigerant Charge Verification

CF-6R-Mech-25-HERS

The contractor completes this form for Refrigerant Charge Verification - Standard Measurement Procedure and Temperature Measurement Access Holes and Saturation Temperature Measurement Sensors, if applicable.

CF-6R-Mech-26-HERS

The contractor completes this form for Refrigerant Charge Verification – Alternate Charge Procedure and Temperature Measurement Access Holes and Saturation temperature Measurement Sensors, if applicable. This uses the "Weigh-in Method"

CF-4R-MECH-20, 21, 22, 24, 25

There are corresponding Certificate of Field Verification and Diagnostic Testing forms for all of the CF-6R-HERS (except CF-6R-Mech-26-HERS) and are completed by a certified HERS Field Verification and Diagnostic Testing rater. These documents are created in a Provider's database registry and are generated with a unique registration number.

Final Note on Required Documentation:

As of October 1st, 2010 for the building inspector's final inspection, all documents shall be registered through a Provider's registry. That means the CF-1R and CF-6R forms can no longer be filled out by hand* and must be computer generated and registered with a unique registration number from a Provider.

** "The CF-1R-ALT-HVAC form (or CF-1R-ALT form) shall be completed by hand, signed, and submitted along with the building permit application by the individual applying for the permit. This form will not be registered at the time of permit application."* The CF-1R will need to be registered by final inspection.

2008 Energy Code Update

Effective January 1st, 2010

	2008 Residential Compliance Manual (Prescriptive)		
	Additions, Alterations and Repairs-HVAC **Pages 8-21 thru 8-26**		
Climate Zone	HERS Field Verification and Diagnostic Testing		
	Duct Sealing Verification (Altered[3] systems with >40' of ductwork in unconditioned space[4])	Refrigerant Charge and Airflow (300 cfm/ton) Temperature Measurement Access Holes (Altered[3] systems)	Cooling Coil Airflow (350 cfm/ton) Fan Watt Draw (0.58 w/cfm) Saturation Temperature Measurement Sensors Temperature Measurement Access Holes Static Pressure Probe Access
1	**Not Required**		**Not Required**
2	**Required**		**Not Required**
3 thru **7**	**Not Required**		**Not Required**
8	**Not Required**	**Required**	**Not Required**
9	**Required**		**Not Required**
10 thru **15**	**Required**		**Required For *"New or Replacement Space-Conditioning Systems"*** [1]
16	**Required**	**Not Required**	**Not Required**

[1]A *new or replacement space conditioning system* installed in an existing dwelling includes a completely new or replacement duct system[2] and a completely new or replacement air handler.

[2]A *completely new or replacement duct system* can also include existing parts of the original duct system (e.g., register boots, air handler, coil, plenums, etc.) if those parts are *accessible* and they can be sealed.

[3] A space -conditioning system is altered by the installation of or replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger.

[4] When >40' of ductwork is added, replaced or extended in unconditioned space, duct sealing and verification is required in climate zones 2, 9-16.

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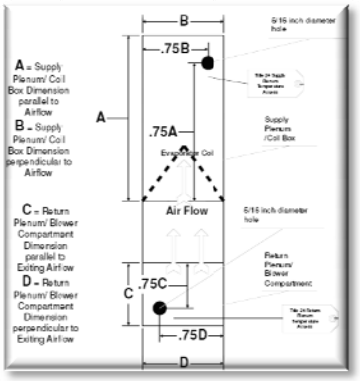
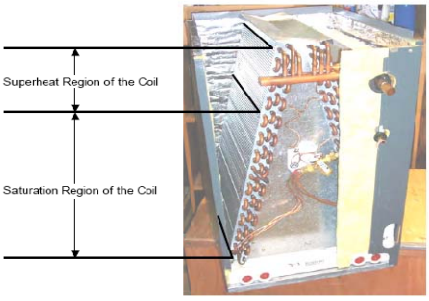
- Temperature Measurement Access Holes provides a non-intrusive means for refrigerant charge verification by HERS raters and other third party inspectors, since it eliminates the need for the raters/inspectors to drill holes into the installed air conditioning equipment enclosures for placement of temperature sensors.



the

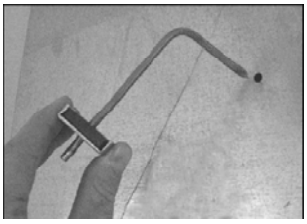
Residential Compliance Manual 4.3.2

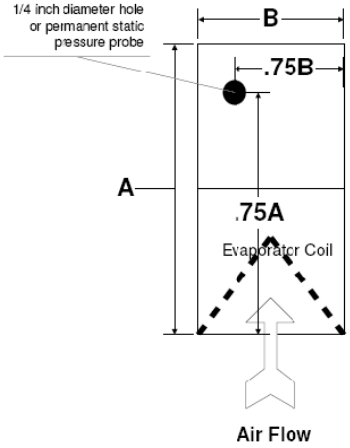
- The Saturation Temperature Measurement Sensors (STMS) provides a non-intrusive means for refrigerant charge verification by HERS raters and other third party inspectors, since it eliminates the need for the raters/inspectors to open the system's refrigerant service access ports to install refrigerant pressure gauges on the suction and discharge lines.



2008 Residential Compliance Manual ***4.3.2***

In the supply plenum there must be a hole provided by the installing contractor for the placement of a static pressure probe (HSPP) or a permanently installed static pressure probe (PSPP), downstream of the evaporative coil. These are required in order to facilitate cooling coil airflow measurement using devices/procedures that depend on supply plenum pressure measurements.





2008 Residential Compliance Manual ***4.3.2***

About the Author:

Greg Davis, Certified HERS Rater/CBPCA Lead Trainer for HERS

Greg is the lead CBPCA HERS trainer and has been a Certified HERS Rater for many years. He has been a strong advocate for building performance and the Home Energy Rating System (HERS). He understands building performance from many different perspectives and has documented the meaningful value that energy efficiency adds through his experience in the Mortgage Finance and Home Improvement industries. Greg has used his diverse experience to help facilitate in the writing of the 2008 Building Standards and developed the CBPCA HERS classroom and training materials. He has first-hand experience implementing the Title 24 Energy Efficiency Standards and understands the challenges building departments face in ensuring code compliance.

About the Publisher:

The ***California Building Performance Contractors Association*** (CBPCA) is a non-profit organization that was formed in 2001 as an answer to our state's increasingly scarce and expensive energy supply. CBPCA was formed to encourage a revolution in home improvement by introducing "building performance contracting" to California's 13 million-plus homes.

CBPCA is the only organization in California that delivers integrated training in energy efficiency, indoor comfort, healthier indoor air, and a safer, more durable building. Our Home Performance with Energy Star training curriculum includes HVAC systems, attic and wall insulation, air infiltration, duct sealing and moisture control, just to name a few.

CBPCA is also California's first and only HERS provider that the California Energy Commission has approved with a Third Party Quality Control Program. CBPCA provides training for HERS Raters, Third Party Quality Control Installers, and Home Performance Contractors using automated diagnostic testing.

For more information on the CBPCA, visit their website at:
www.cbpca.org